PROJECT MANUAL

VOLUME 1 of 2

Additions & Renovations Emerald High School

GREENWOOD SCHOOL DISTRICT 50
GREENWOOD, SOUTH CAROLINA

JCS Commission No. 21010

January 2023

VOLUME 1

VOLUME 2

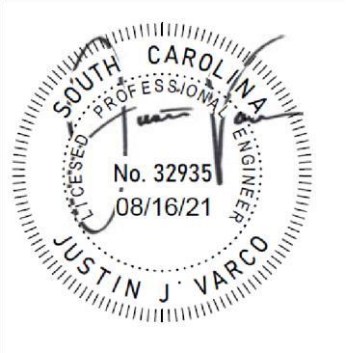
33 4616 Subdrainage

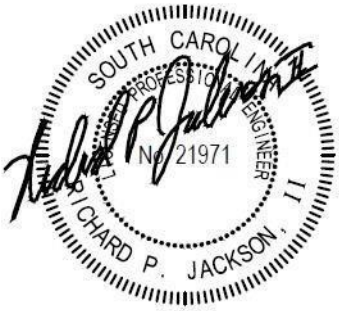
APPENDIX 'A'
ASHRAE 90.1-2007 COMcheck Mechanical Systems (HVAC) & Water Heating Compliance

APPENDIX 'B'
ASHRAE 90.1-2007 COMcheck Lighting Compliance Certificate

APPENDIX 'C'
ASHRAE 90.1-2007 COMcheck Envelope Compliance Certificate

END OF SECTION





SECTION 00 0107 SEALS PAGE

Sealed bids for Contractors, qualified under provisions of the Contractor's Licensing Law of the State of South Carolina (Secs. 40-11-10 -40-11-350 of Code of Laws, 1976, as amended to date) will be received by the Owners, **GREENWOOD SCHOOL DISTRICT 50 on Tuesday, March 14, 2023 at 2:00 pm** to be publicly opened and read aloud at the **GREENWOOD SCHOOL DISTRICT 50, 1855 Calhoun Rd, Greenwood, SC 29649** for all work in connection with the **Emerald High School – Additions & Renovations**

A Pre-Bid Conference will be held on **Friday, February 10, 2023 at 10:00 a.m.** at **Emerald High School, 150 Bypass 225, Greenwood, South Carolina 29646**. This is a non-mandatory pre-bid conference however all prospective offerors are strongly urged to attend.

Bidding Documents may be obtained from the Architects, Jumper Carter Sease/Architects P.A.; 412 Meeting Street, West Columbia, S.C. 29169. A link will be provided to the invited bidders to download Plans and Specifications.

Bidding Documents may be examined at the office of the Architect in West Columbia, S.C.

Bids must be accompanied by a Bid Bond or certified check in an amount of not less than five percent (5%) of the base bid pledging that the bidder will enter into a contract with the Owner for the terms stated in the bid.

Both Performance Bond and Payment Bond will be required in an amount equal to 100 percent of the contract price. All bonds shall be by a Surety Licensed in the State of South Carolina with an "A" minimum rating of performance and financial strength of at least five (5) times the contract amount, including add alternates, as listed in the most current publication of "Best's Key Rating Guide Property Liability". All bonds shall be accompanied by a "Power of Attorney" authorizing the attorney in fact to bind the surety and certified to include the date of bond.

The Owner reserves the right to reject any or all bids and to waive technicalities and informalities.

No bid may be withdrawn for a period of 60 days after date and time set for opening of bids.

BY: **Mr. Rodney Smith, Assistant Superintendent GREENWOOD SCHOOL DISTRICT 50, 1855 Calhoun Rd**
Greenwood, SC 29649
(864) 941-5400 INVITATION TO BID 00 0200 - Page 1 of 1

PART 1 - GENERAL

1.1 Related Documents

1.1.1 Documents affecting work of this section include, but are not necessarily limited to, the contract documents, addenda and General and Supplementary Conditions.

1.2 Products Lists

1.2.1 Within the bidding period for non-specified manufacturers of items specified by reference standards, submit to Architect/Engineer digital copy of complete list of major products, which are proposed for installation.

1.2.2 Tabulate products by specifications' section number and title.

1.2.3 For products only by reference standards, list for each product:

A. Name and address of manufacturer

B. Trade name

C. Model or catalog designation

D. Manufacturer's data:
1) Reference standards
2) Performance test data

1.3 Contractor's Options

1.3.1 For products specified only by reference standard, select product meeting that standard by any manufacturer.

1.3.2 For products specified by naming several products or manufacturers, select any one of the products and manufacturers named which complies with the specifications.

1.3.3 For products specified by naming several products or manufacturers and stating "or equivalent", "or equal," or "or approved equal" submit a request as for substitutions, for any product or manufacturer which is not specifically named.

1.4 Substitutions

1.4.1 Contractor's Base Bid shall be in strict accordance with the drawings and project manual. Contractor has the option of requesting substitutions during the bidding period by submitting completed substitution requests a minimum of ten (10) days prior to Bid Date.

A. After end of that period, requests will be considered only in case of product unavailability or other conditions beyond the control of the Contractor.

1.4.2 Submit separate requests for each substitution. Support each request with the following:

A. Complete data substantiating compliance of proposed substitution with requirements stated in contract documents:
   1) Product identification, including the manufacturer's name and address. 2) Manufacturer's literature; identify:
      a. Product description
      b. Reference standards
      c. Performance and test data 3) Samples, as applicable.
   4) Name and address of similar projects on which product has been used, and date of each installation.

B. Itemized comparison of the proposed substitution with product specified; list significant variations.

C. Data relating to changes in construction schedule.

D. Any effect of substitution on separate contracts.

E. List of changes required in other work or products.

F. Designation of required license fees or royalties.

G. Designation of availability of maintenance services, sources of replacement materials.

1.4.3 Substitutions will not be considered for acceptance when:

A. They are indicated or implied on shop drawings or product data submittals without formal request from Contractor.

B. Acceptance will require substantial revision of contract documents.

C. In the judgment of Architect/Engineer, do not include adequate information necessary for a complete evaluation.

D. If requested after contract award directly by a trade Contractor, sub-contractor or supplier.

1.4.4 Substitute products shall not be ordered or installed without written acceptance of Architect/Engineer.

1.4.5 Architect/Engineer will determine acceptability of proposed substitutions.

1.5 Contractor's Representation

1.5.1 In making formal request for substitution, Contractor represents the following:

A. He has investigated the proposed product and has determined that it is equivalent to or superior in all respects to that specified.

B. He will provide same warranties or bonds for substitution as for product specified.

C. He will coordinate installation of accepted substitution into the work, and make such changes as may be required for the work to be complete in all respects.

D. He waives claims for additional costs caused by substitution, which may subsequently become apparent.

1.6 Architect/Engineer Duties

1.6.1 Review Contractor's request for substitutions with reasonable promptness.

1.6.2 Notification to Contractor shall be in accordance with contract documents.

1.7 Substitution Request Form

1.7.1 See Section 00 43 25 for Substitution Request Form.

END OF SECTION

TO: **GREENWOOD SCHOOL DISTRICT 50 1855 Calhoun Road Greenwood, South Carolina 29649 (864) 941-5400**

DATE: _____

FROM:

(BIDDER)

BASE BID: The undersigned, having carefully examined the drawings and specifications including Instructions to Bidders, entitled:

Architects Commission Number: **22016** dated **January 2023** for all work in connection with:

EMERALD HIGH SCHOOL – ADDITIONS & RENOVATIONS

ADDENDUM NO. _____ DATED _____ ADDENDUM NO. _____ DATED _____

ADDENDUM NO. _____ DATED _____ ADDENDUM NO. _____ DATED _____

As well as the premises and conditions affecting the work, proposes to furnish all services, labor, materials and equipment called for to complete the work in accordance with the contract documents for the following Lump Sum Amount:

_____ (DOLLARS) $

Bid Holding Time: Undersigned hereby agrees that this bid may not be revoked or withdrawn after the time set for opening of bid but shall remain open for a period of ___30___ days following such time.

Contract Acceptance: In case the Undersigned be notified in writing or by mail, telegraph or delivery of the acceptance of his bid within sixty days after the time set for the opening of bids, he agrees to execute within fourteen (14) days from "Notice to Proceed" a Contract Agreement to complete the work in accordance with the Contract Documents based on the above stated Base Bid.

BID SECURITY: Enclosed is a Bid Bond or Certified check in the amount of _____ _____DOLLARS ($_____) being not less than five percent of the Base Bid, payable to the Owner. The Undersigned agrees that the above stated amount is the proper measure of liquidated damages which Owner will sustain by failure of the Undersigned to execute a Contract, and to furnish the Performance Bond and Labor and Material Payment Bond within the 10 day period from notice, in case the Bid is accepted by the Owner within 60 days after the date set for the opening of bids. The Undersigned agrees that, if he is unwilling to execute the contract within the 10 day period from date, or if he fails to furnish both Performance Bond and Labor and Material Payment Bond, the obligation of the Bid Bond will remain in full force and effect and the monies payable thereon shall be paid into the funds of the Owners as liquidated damages for such failure.

PROJECT COMPLETION: This project shall be completed per the following:

AREA	**START WORK**	**COMPLETION**
New building	Upon Notice to Proceed, April 4, 2023	Substantial completion, December, 31, 2023

LIQUIDATED DAMAGES: Should the Contractor fail to substantially complete the work under this Contract within the time specified herein before, or such later date as may result from an authorized extension of time, he shall pay to the Owner, as liquidated damages, the sum of Two Hundred Fifty Dollars per calendar day ($250.00) commencing on the first day following expiration of the Contract Time and continuing until the actual date of Substantial Completion. Such liquidated damages are hereby agreed to be a reasonable pre-estimate of damages the Owner will incur as a result of delayed completion of the Work

THIS PROPOSAL HAS BEEN PREPARED USING THE FOLLOWING SUBCONTRACTORS:

SPECIALTY	**NAME**
FIRE/SPRINKLER	
MECHANICAL	
ELECTRICAL	
PLUMBING	
MASONRY	
ROOFING	

Other major subcontractors shall be provided to the Architect within two (2) working days of the Bid opening.

No other subcontractors for the disciplines noted, other than listed above, shall be used without the express consent of the Owner. In case of bid overrun where it is necessary to negotiate a price reduction in this project, the General Contractor shall first confine his negotiations with the above named subcontractors. Failing to satisfactorily conclude such negotiations, the General Contractor shall submit to the Owner and the Architect for approval a minimum of five (5) additional bidders for each trade for which he wishes to negotiate.

The undersigned declares that the person of persons signing this proposal is/are fully authorized to sign the proposal on behalf of the firm listed and to fully bind the firm listed to all conditions and provisions thereof.

It is agreed that no person or persons or company other than firm listed below or as otherwise indicated therein after has any interest whatsoever in this proposal or the contract that may be entered into as a result thereof and that in all respect the proposal is legal and fair submitted in good faith without collusion or fraud.

Respectfully submitted,

_____
BIDDER'S FIRM NAME

_____
ADDRESS

STATE OF SOUTH CAROLINA LICENSE NO. _____

BY: _____
TITLE: _____

SEAL IF BIDDER IS A CORPORATION

SUBSTITUTION REQUEST FORM

TO:

PROJECT: **EMERALD HIGH SCHOOL – ADDITIONS & RENOVATIONS**
GREENWOOD SCHOOL DISTRICT 50

We hereby submit for your consideration the following product instead of the specified item for the above project:

Drawing Spec. Sect. No. Paragraph Specified Item

_____ _____

Proposed Substitution:

Attach complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

Submit with request all necessary samples and substantiating data to prove equal quality and performance to that which is specified. Clearly mark manufacturer's literature to indicate equality in performance.

Fill in blanks below:

A. Does the substitution affect dimensions shown on the Drawings?

Yes___ No ____

If yes, clearly indicate the changes:

B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution? Yes ___ No ___

C. What effect does substitution have on other Contracts or other Trades?

D. What effect does substitution have on construction schedule?

E. Manufacturer's warranties of the proposed and specified items are:

Same _____Different _____(Explain on attachment.)

F. Reason for request:

G. Itemized comparison of specified item(s) with the proposed substitution; list significant variations:

H. Accurate cost date comparing proposed substitution with product specified:

I. Designation of maintenance services and sources:
(Attach additional sheets if required)

_____
_

CERTIFICATE OF EQUAL PERFORMANCE AND ASSUMPTION OF LIABILITY FOR EQUAL PERFORMANCE

The undersigned states that the function, appearance and quality are equivalent or superior to the specified item.

Submitted By:

_____
Remarks:_____ Firm

_____
Address

_____
Telephone Date

Signature shall be by person having authority to legally bind his firm to the above terms. Failure to provide legally binding signature will result in rejection of proposed substitution.

_____
Signature Title **For Use By Architect:**

____Accepted ____Accepted as Noted

____Not Accepted ____Received Too Late

By:_____
_

Date:_____

_____

_____

_____

_____

_____

_____

1.0 GENERAL

1.01 FORM OF AGREEMENT: The form of agreement shall be AIA Document A101 - 2017, "Standard Form of Agreement Between Owner and Contractor ", published by the American Institute of Architects, copy of which is available from the Architects, upon written request and cost of reproduction. 10% of all payment requests shall be held as retainage. At 50% of project completion, retainage may be stopped with the consent of surety and provided the project is on schedule, work quality appears to be in compliance with plans and specifications, and there is no evidence of unpaid bills.

1.02 PERFORMANCE AND PAYMENT BOND: The form of performance and payment bond required under this contract will be AIA Document A101 - 2017, "Performance Bond and Payment Bond", published by the American Institute of Architects, and is available at the AIA Office in Columbia, telephone no. (803) 252-6050.

1.03 GENERAL CONDITIONS: The "General Conditions of the Contract for Construction", AIA Document A101 - 2017, A Standard Document of and published by the American Institute of Architects is hereby made a part of these specifications, and, except as modified and supplemented by Section entitled "Supplementary Conditions", are the general conditions on which all contracts for this work will be based.

1.04 OTHER FORMS: Shall be AIA Documents of the latest editions.

END OF SECTION

1.0 GENERAL

1.1 The following supplements modify the "General Conditions of the Contract for Construction", AIA Document A201, 2007 Edition. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

1.2 ARTICLE 1; GENERAL PROVISIONS

1.2 Execution, Correlation and intent

Add the following subparagraph to 1.2.1.

.1 In the event of conflicts or discrepancies among the Contract Documents interpretations will be based on the following priorities:

1. The Agreement

2. Addenda, with those of later date having precedence over those of earlier date.

3. The Supplementary Conditions.

4. The General Conditions of the Contract for Construction.

5. Drawings and Specifications.

In case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.

1.3 ARTICLE 2; OWNER

Delete subparagraph 2.2.5 and substitute the following:

2.2.5 The Contractor will be furnished a CD or electronic files of the plans and specifications for his/her use. The Contractor shall be responsible for adding addenda, supplemental drawings, field drawings and other items or directives to these documents on the CD or in some format so construction is inclusive of all previously stated documents.

1.4 ARTICLE 3; CONTRACTOR

3.4 Labor and Materials

Add the following subparagraphs 3.4.4 and 3.4.5 to 3.4:

3.4.4 After the contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications).

3.4.5 By making requests for substitutions based on subparagraph 3.4.4 above, the contractor:

50 SUPPLEMENTARY CONDITIONS

.1 Represents that the contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

.2 Represents that the contractor will provide the same warranty for the substitution that the contractor would for that specified.

.3 Certifies that the cost data presented is complete and includes all related costs under this contract except the Architect's redesign costs, and waives all claims of additional costs related to the substitution which subsequently become apparent; and

.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.

3.6 Taxes

Add the following subparagraph 3.6.2.

3.6.2 Non-Residents Withholding Tax: The Contractor attention is directed to Section 12-9-310 of the South Carolina Income Tax Code dealing with "Withholding Agents and Withholdings", a portion of which is stated below to acquaint bidders with the requirements.

.1 Any Owner hiring or contracting or having a contract with any non-resident contractor, where such contract exceeds $10,000 or can be expected to exceed this amount, shall be required by law to withhold 2 percent of each and every payment made after January 1, 1960 to such non-resident. The provisions of this law cover not only non-resident individuals and partnerships, but foreign corporation as well.

.2 If a Contractor has any employees earning income in South Carolina who are legal residents of another state, he also becomes a withholding agent and must withhold South Carolina income taxes from the earnings of the non-resident employees on the basis of tables furnished by the SC Tax Commission. If the General Contractor subcontracts with other non-resident contractors, he must withhold 2 percent of each and every payment made to the subcontractor if the total amount of the subcontract exceeds $10,000 or can be expected to exceed that amount. The subcontractor may obtain the same relief as the General Contractor by posting the bond described below.

.3 The conditions set forth above may be waived by the SC Tax Commission provided the payee shall insure the Tax Commission by bond, secured by any insurance company licensed by the SC Insurance Commission, or deposit of securities subject to the approval of the State Treasurer, or cash, which shall bear no interest, and that the payee will comply with all applicable provisions of the Income Tax Act of 1962, as amended, and with the withholding requirements insofar as his obligation as a withholding agent is concerned.

1.5 ARTICLE 4; ADMINISTRATION OF THE CONTRACT

4.6 Arbitration

Delete the following subparagraphs 4.6.1 through 4.6.6

1.6 ARTICLE 7; CHANGES IN THE WORK

7.3 Construction Change Directives

7.3.6 In the first sentence, delete the words "A reasonable allowance for overhead and profit" and substitute "An allowance for overhead and profit in accordance with clauses 7.3.10.1 through 7.3.10.6 below":

Add the following subparagraph 7.3.10 to 7.3:

7.3.10 In subparagraph 7.3.6, the allowance for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

.1 For the contractor, for work performed by the Contractor's own forces, 10 percent of the cost.

.2 For the contractor, for work performed by the Contractor's subcontractor, 5 percent of the amount due the subcontractor.

.3 For each subcontractor or subcontractor involved, for work performed by that subcontractor's or subcontractor's own forces, 10 percent of the cost.

.4 For each subcontractor, for work performed by the subcontractor's subcontractors, 5 percent of the amount due the subcontractor.

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.

.6 In order to facilitate checking of quotations for extras of credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also.

1.7 ARTICLE 9; PAYMENT AND COMPLETION

Add the following paragraph 9.11 to Article 9:

9.11 Liquidated Damages

9.11.1 The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner the sums hereinafter stipulated as liquidated damages in addition to actual damages for each calendar day of delay until the work is substantially complete as stated in Section 01 3210.

1.8 ARTICLE 11; INSURANCE AND BONDS

11.1 Contractor's Liability Insurance

11.1.1.9 Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:

.1 Premises Operations (including X, C, and U coverages as applicable).

.2 Independent Contractors' Protective.

.3 Products and Completed Operations.

.4 Personal Injury Liability with Employment Exclusion deleted.

.5 Contractual, including specified provision for Contractor's obligation under Paragraph 3.18.

.6 Owner, non-owned and hired motor vehicles.

.7 Broad Form Property Damage including Completed Operations.

11.1.1.10 If the General Liability coverages are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2.

Add the following Clause 11.1.2.1 to 11.1.2:

11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits, or greater if required by law:

A. Comprehensive General Liability (including Premises-Operations, Independent Independent Contractor's Protective, Products and Completed Operations, Broad Form Property Damage)

1. Commercial: General Liability

a. General Aggregate $2,000,000.00

b. Products Completed/ Operations Aggregate $2,000,000.00

c. Personal Injury $1,000,000.00

d. Bodily Injury/Property Damage Liability $1,000,000.00

2. Owner's & Contractor's Protection

a. Each occurrence $1,000,000.00

b. Fire Damage (any once fire) $100,000.00

c. Medical Expense (any one person) $5,000.00

3. Products and Completed Liability Operations coverage to be maintained for at least 1 year after Final Payment.

4. Property Damage Liability Insurance shall include Explosion, Collapse, and Underground Coverage as applicable.

B. Automotive Liability $1,000,000.00
Any auto-combined single limit

C. Excess Liability
Umbrella form-aggregate $5,000,000.00

D. Workmen's Compensation and Employer's Liability

a. Workmen's Compensation Ins. SC Statutory Benefits

b. Employers Liability Insurance $500,000.00 (Ea. Accident)

c. Policy limit $1,000,000.00

d. Each employee $500,000.00

E. Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including.

a. Premises operations (including explosion, collapse and under- ground as applicable)
b. Independent contractor's protective
c. Products and completed operations
d. Personal injury with employment exclusion deleted
e. Contractual, including specified provisions for Contractor
e. Owner, non-owned, and hired motor vehicles
f. Broad form property damage including completed operations
g. Umbrella $1,000,000.00 limit.

11.5 PERFORMANCE BOND AND PAYMENT BOND

Delete subparagraph 11.5.1 and substitute the following:

11.5 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the contractor's usual source and the cost thereof shall be included in the contract sum. The amount of each bond shall be equal to 100 percent of the Contract Sum.

11.4.1.1 The contractor shall deliver the required bonds to the Owner not later than three days following the date the Agreement is entered into, or if the Work is to be commenced

prior thereto in response to a letter of intent, the Contractor shall, Prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

END OF SECTION

1.0 GENERAL

The provisions of the Instruction to Bidders and of the Special Conditions, General Conditions, and Supplementary Conditions of these Specifications shall govern the work under this Division or Section the same as if incorporated herein.

1.1 QUALITY ASSURANCE

Qualifications of Manufacturers: Products used in the Work shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of successful production acceptable to the Architect/Engineer.

Qualifications of Workmen: Use adequate numbers of workmen who are thoroughly trained and experienced in the necessary skills, completely familiar with the manufacturer's recommended methods of application and completely familiar with the specific requirements of the work.

Codes and Standards: Comply with the 2018 Edition of the International Building Code or other Governing Local Codes and Standard. Comply also with all instructions and recommendations from the manufacturers of various materials. Notify Architect immediately of any systems which do not comply with the 2018 International Building Code or any local codes that may be more stringent.

1.2 PRODUCT HANDLING

Delivery and Storage:

Deliver all packaged materials to the job site in their original unopened containers with all labels intact and legible at time of inspection.

Store all materials in an approved manner, protecting from contact with soil and from exposure to the elements. Limit the amount of weight of materials placed on roofs or floors not on grade at anytime making sure stored materials are DISTRIBUTED OVER LARGE AREAS AND NOT CONCENTRATED.

Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

1.3 SCHEDULING AND COORDINATION

All work times shall be scheduled and coordinated with the Owner/Architect.

1.4 MATERIAL AND WORKMANSHIP

Fitting Job Conditions: The Contractor and material suppliers shall be responsible for inspecting all job conditions affecting the installation of an item and taking all field measurements required prior to fabrication of an item to ensure that the item concerned will integrate properly with all adjacent materials and fit all other conditions as they exist or will exist in the finished project.

1.5 CODES AND LAWS

All construction will comply with the latest edition of the 2018 International Building Code, National Fire Protection Association Code, Section 504 of the Rehabilitation Act of 1973 and all general and permanent Laws of the State of South Carolina. This District places major emphasis on the safety and well-being of its students, faculty and staff. It is the first duty of supervisors and all other persons in authority to provide for safety and fire prevention.

1.6 OCCUPATIONAL SAFETY AND HEALTH

The construction shall be governed, at all times, by applicable provisions of the Federal Law(s), including but not limited to the following, as amended to date.

Williams-Steiger Occupational Safety and Health Act of 1970, Public Law 91596.

Part 1910 - Occupational Safety and Health Standards, Chapter XVII of Title 29, Code of Federal Regulations; and

Part 1518 - Safety and Health Regulations for Construction, Chapter XIII of Title 29, Code of Federal Regulations.

END OF SECTION

1.0 GENERAL

1.1 SCOPE: This section lists known special conditions that exist or pertain to the Contract Documents.

1.2 SPECIAL CONDITIONS:

A. ASBESTOS: It is the intent of the plans and specifications to specify only nonasbestos containing materials. Asbestos is defined as follows:
ASBESTOS - The asbestiform varieties of serpentine (chrysotile), rie bekite (crocidolite), cummingtonite grunerite (amosite), anthrophyllite, actinolite, and tremolite.
Materials containing any form of asbestos in any percentages shall not be used.
PRODUCTS SHALL BE ASBESTOS FREE. Suppliers supplying materials containing asbestos in any form or percentages shall be responsible for the removal of these materials if delivered or installed and any cleanup required, in addition to the installation of asbestos free materials.

B. HEAVY METALS: It is the intent of these plans and specifications to specify materials containing NO HEAVY METALS BY DESIGN. Heavy metals are defined as mercury, lead and other metals known to cause bodily harm. Lead products may be used in roofing applications. Lead soldering for any water or waste water is not allowed. Products containing heavy metals may be used only with the written permission of the architect. Cleanup for products, containing heavy metals, installed without written permission shall be at the contractor's expense.
Installation of new non-heavy metal products shall be at no cost to the owner.

C. OCCUPANCY BY THE OWNER:

1. Construction of this new facility will occur on an active and occupied school site
2. This site will be occupied, for the duration of this project, by Students, School and District Personnel, Staff, Parents, and others.
3. The contractor shall maintain adequate security fencing to provide separation between the school occupants and construction workers and equipment.

D. The Contractor, His Subcontractors and/or Personnel Employed by either shall:

1. Remain in the designated work areas.
2. Maintain a safe work site at all times.
3. Schedule all work with the Owner.
4. Remain fully clothed at all times on or around job site.
5. Have no verbal contact with students or staff.
6. Sunday work will be allowed.
7. In accordance with State Law, this facility is a No Smoking Facility. An exterior smoking area will be established by the Owner and any smoking shall occur at that area

D. **Davis Bacon Act of 1931:**

1. Shall be adhered to on this project. Davis Bacon Act of 1931is a United States federal law that establishes the requirement for paying the local prevailing wages on public works projects for laborers and mechanics. It applies to "contractors and subcontractors performing on federally funded or assisted contracts in excess of $2,000 for the construction, alteration, or repair (including painting and decorating) of public buildings or public works."

3.0 NOT USED

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Work covered by the Contract Documents.
2. Use of premises.
3. Owner's occupancy requirements.
4. Specification formats and conventions.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: **EMERALD HIGH SCHOOL – ADDITIONS & RENOVATIONS**

B. Project Location: **150 Bypass 225, Greenwood, South Carolina 29646**

C. Owner: **Greenwood School District 50**

1. Owner's Representative: **Mr. Rodney Smith, Assistant Superintendent**

D. The Work consists of a **EMERALD HIGH SCHOOL – ADDITIONS & RENOVATIONS** per the contract documents.

Work consists of a new secure entrance. Project includes load bearing masonry brick veneer. Structural steel joists with tpo membrane roof. Aluminum windows & doors and frames. New HVAC rooftop units, fire sprinkler system, plumbing systems. Full electrical system including LED lighting, IT system, and fire alarm system.

E. The project will be constructed by design-bid-build method of construction.

1.3 WORK UNDER OTHER CONTRACTS

A. Concurrent Work: Owner may elect to award separate contract(s) for other construction operations at Project site. Those operations may be conducted simultaneously with work under this Contract.

1.4 USE OF PREMISES

A. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner and Owner Contractors occupancy of Project site as required to complete scopes of work.

2. Driveways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.6 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 33-division format and CSI/CSC's "MasterFormat" 2011 Version numbering system.

1. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.

2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 – PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

PART 1GENERAL

1.01 DESCRIPTION

A. Work Included: This section applies to situations in which the Contractor or his representatives including, but necessarily limited to, suppliers, subcontractors, employees and field engineers, enter upon the Owner’s property.

B. Related Work: Documents affecting work of this section include, but are not necessarily limited to, the contract documents, addenda and General and Supplementary Conditions.

1.02 QUALITY ASSURANCE

A. Promptly upon the award of the Contract, notify all pertinent personnel regarding requirements of this Section.

B. Require that all personnel who will enter upon the Owner's property certify their awareness of and familiarity with the requirements of this section.

1.03 SUBMITTALS

A. Maintain an accurate record of the names and identification of all visitors entering upon the Owner's property in connection with the work of this contract, including times of entering and times of leaving, and submit a copy of the record to the Owner weekly.

1.04 TRANSPORTATION FACILITIES

A. Truck and equipment access: (1) To avoid traffic conflict with vehicles of the Owner's employees and customers, and to avoid over-loading of street and driveways elsewhere on the Owner's property, limit the access of trucks and equipment to the designated "Contractor's Entrance". (2) Provide adequate protection for curbs and sidewalks over which trucks and equipment pass to reach the job site.

B. Contractor's vehicles: (1) Require contractor's vehicles, vehicles belonging to employees of the contractor, and all other vehicles entering the Owner's property in performance of the work the contract, to use only the designated Access Route. (2) Do not permit such vehicles to park on any street or other area of the Owner's property except in the area to be designated.

1.05 SECURITY

A. Restrict the access of all persons entering upon the Owner's property in connection with the work to the Contractor's Entrance and to the actual site of the work.

1.06 CONTRACTOR USE OF PREMISES

A. Confine operations at site to area permitted by Owner and Contract Documents.

B. Do not unreasonably encumber site with materials or equipment.

C. Do not load structure with weight that will endanger structure.

D. Assume full responsibility for protection and safekeeping of products stored on premises.

E. Move any stored products, which interfere with operations of Owner.

1.07 OWNER OCCUPANCY

A. The Contractor shall schedule his operations for completion of portions of the Work, and coordinate work sequence relating to the existing and new buildings for the Owner's final occupancy upon Completion of the entire Work.

B. The Contractor agrees to permit the Owner to use and occupy a portion or unit of the project before formal acceptance of the total project by the Owner provided the Owner:

1. Secures written consent of the Contractor (except in the event in the opinion of the Architect, the Contractor is chargeable with unwarranted delay in final cleanup of punch list items or other contract requirements, the Owner may occupy without Contractor' s consent);

2. Secures endorsement from the insurance carrier and consent of the surety to permit occupancy of the building or use of the project during the remaining period of construction;

1.09 CONTRACTOR CONDUCT

A. The use of tobacco products on district property is prohibited.

B. The possession and/or use of drugs and alcohol on district property are prohibited.

C. No improper language or fraternization by Contractor’s employees with student and staff are prohibited.

D. All contract personnel shall be required to wear long pants and sleeved shirts at all times while on Owner’s property.

E. Contractor must adhere to noise and other applicable local ordinances END OF

SECTION

1.0 GENERAL

1.1 Time for Completion: Attention is directed to the fact that the building and facilities are urgently needed by the Owner and that time is of the essence; for this reason, it shall be agreed that the Contractor shall begin work and complete work as listed in the following scheduled:

Start Date	**Completion Date**	Upon Notice to Proceed
On or about April 4, 2023	December 31, 2023	

1.2 The following schedule depicts working days per calendar month (non cumulative) that shall be anticipated as normal inclement weather. Such time will not be considered justification for an extension of time. Inclement weather days in excess of normal inclement weather days listed, are justification for extension of time. Inclement weather days on Saturday, Sunday and holidays will not be allowed unless work has been scheduled and the Architect notified prior to said days. Time extensions will be granted only if the critical path has been affected. Extensions of time will be calendar days and not working days.

January 4 days	April 3 days	July 3 days	October 3 days
February 4 days	May 3 days	August 4 days	November 3 days
March 3 days	June 3 days	Sept 3 days	December 3 days

1.3 SUBSTANTIAL COMPLETION:

A. The Contractor shall inspect the entire project with his subcontractors. A list of incorrect/incomplete items will be forwarded to the Architect. The Contractor shall immediately start correcting this list and date the items as they are completed. NEITHER THE ARCHITECT NOR THE ENGINEERS WILL START THEIR PUNCH LIST PRIOR TO RECEIVING THE CONTRACTOR'S COMPLETED LIST.

B. The final inspection shall be made by the Architect and his consultants after the contractors list with dated corrections is received by the Architect. A list of these incorrect/incomplete items will be forwarded to the contractor.

C. Contractor shall have 30 calendar days to correct all items and at that time shall certify in writing that all items are correct and complete. Monies will be withheld from the contract until all Punch List items are acceptable by the Architect. Punch list shall be corrected at the owner’s convenience. At substantial completion, the facility will be occupied. Therefore, all remaining punch list items following substantial completion will have to be corrected when the facility is not being used by the owner.

END OF SECTION

1.0 GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract including General & Supplementary Conditions and other Division-1 specification sections, apply to work of this section.

1.2 SCOPE: This section describes the allowances that are to be included in the contractor's bid and entered on the Form of Proposal

1.3 ALLOWANCE: The following allowances to be used as directed by Architect. Any unused portion of these allowances shall be credited to the Owner at the completion of the work. These allowances shall be considered actual costs and the contractor's profit, insurance, taxes, installation cost, and protection of installed products, will be figured in the bids, except as otherwise noted.

1.4 HARDWARE ALLOWANCE:
$**8,000** - including Material, S.C. Sales Tax and Installation.

1.6 SIGNAGE:
$10,000.00 - including Material, S.C. Sales Tax and Installation.

1.7 LANDSCAPING AND IRRIGATION:
$50,000.00 – Including Material, SC Sales Tax and Installation.

1.8 UTILITY FACE BRICK:
$1,200.00/1000 brick– Including Material, and SC Sales Tax.

1.9 SECURITY CAMERAS:
$10,000.00 – Including Material, SC Sales Tax and Installation

1.10 ELECTRONIC LOCKS:
$10,000.00 – Including Material, SC Sales Tax

1.11 EMERGENCY RADIO Coverage:
$40,000.00 - Including Material, SC Sales Tax and Installation

NOTE: Allowance money shall be used as directed by the Owner/Architect for the work list and/or other work as deemed necessary for a successful project by the Owner.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: To enable orderly review during progress of the Work, and to provide for systematic discussion of problems and to coordinate all phases of the Project toward completion in accordance with the Contract Documents, the Architect will conduct project meetings throughout the construction period.

B. Related Work:

1. Documents affecting work of this section include, but are not necessarily limited to, the contract documents, addenda and General and Supplementary Conditions.

2. The Contractor's relations with his subcontractors and materials suppliers are the Contractor's responsibility and normally are not part of project meeting content.

3. This Section specifies administrative and procedural requirements for project meetings including, but not limited to:

a. Pre-construction conferences.
b. Progress meetings.
c. Coordination meetings.
d. Pre-installation conferences.

1.2 QUALITY ASSURANCE

A. For those persons designated by the Contractor to attend and participate in project meetings, provide required authority to commit the Contractor to solutions agreed upon in the project meetings. Any change in personnel by a Contractor will be forwarded in writing to the Architect/Owner prior to the change.

1.3 SUBMITTALS

A. Agenda Items: To the maximum extent practical, advise the Architect/Owner at least 24 hours in advance of project meetings regarding items to be added to the agenda.

B. Minutes:

1. The General Contractor will compile minutes of each project meeting, and will furnish one copy to the Prime Contractors, Architect and required copies to the Owner.

2. Recipients of copies may make and distribute such other copies as they wish.

PART 2 - PRODUCTS

(No products are required in this Section)

PART 3 - EXECUTION

3.1 MEETING SCHEDULE

A. Except as noted for Pre-construction Meeting, formal job site meetings with on site job superintendents will be held weekly.

B. Except as noted for Pre-construction Meeting, formal project meetings with attendance of each Contractor's office Project Manager will be held monthly.

C. Coordinate as necessary to establish mutually acceptable schedule for meetings.

3.2 MEETING LOCATION

A. The Architect/Owner will establish meeting location. To the maximum extent practicable, meetings will be held at the job site.

3.3 PRE-CONSTRUCTION MEETING

A. Pre-construction Meeting will be scheduled to be held within 15 working days after the Owner has issued the Notice to Proceed.

1. Provide attendance by authorized representatives of the Contractor.

2. The General Contractor will advise other interested parties, including the Owner, and request their attendance, as necessary.

B. Minimum Agenda: Data will be distributed and discussed on at least the following items:

1. Organizational arrangement of Contractor's forces and personnel, subcontractors, material suppliers, the Architect/Owner, and the Architect.

2. Channels and procedures for communication.

3. Construction schedule, including sequence of critical work.

4. Contract Documents, including distribution of required copies of original Documents and revisions.

5. Processing of Shop Drawings and other data submitted to the Architect/Owner for transmittal to Architect for review.

6. Processing of Bulletins, field decisions, Change Orders, and Payment Applications.

7. Rules and regulations governing performance of the Work.

8. Procedures for safety and first aid, security, quality control, housekeeping and related matters.

9. Preparation of record drawings.

10. Use of the premises.

11. Office, work and storage areas.

12. Equipment deliveries and priorities.

13. Working hours.

14. Request for Information format.

15. Notification of Defective and Non-Conforming Work format.

16. Rejection of Work format.

3.4 PROJECT MEETINGS A.

Attendance:

1. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work.

2. Conduct progress meetings at the Project site at regularly scheduled intervals. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.

3. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at the meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

B. Minimum Agenda:

1. Review, revise as necessary, and approve minutes of previous meetings.

2. Review progress of the Work since last meeting, including status of submittals for approval. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so.

3. Identify problems which impede planned progress.

4. Develop corrective measures and procedures to regain planned schedule.

5. Complete other current business.

6. Update as-built documents as required.
7. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

8. Review the present and future needs of each entity present, including such items as:

   a. Interface requirements.

b. Time.
c. Sequences.
d. Deliveries
e. Off-site fabrication problems.
f. Access.
g. Site utilization.
h. Temporary facilities and services. I. Hours of work.
j. Hazards and risks.
k. Cleaning and site conditions.
l. Quality and work standards.
m. Change Orders.

n. Documentation of information for payment requests. C.

Revisions to minutes:

1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.

2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.

3. Challenge to minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

D. Reporting: No later than 5 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

END OF SECTION

PART 1GENERAL

A. The Contractor shall submit for review by the Architect/Engineer, Shop Drawings and schedules required by the Specifications, or that may be requested by the Architect/Engineer, and no work shall be fabricated by the Contractor, except at his own risk, until such review has been completed.

1.1 FORM OF SUBMISSION MATERIALS

A. SHOP DRAWING SCHEDULE

1. Immediately after date of Notice to Proceed, each Contractor shall submit to the Architect a Shop Drawing Submittal Schedule, which shall include the following minimum information (**This should be provided at the Pre-Construction Meeting):**

a. List all items to be submitted for review referenced to the specific specifications section.

b. Name of subcontractor if applicable.

c. Supplier and date of purchase order.

d. Total fabrication and delivery time from time submittals are returned to the Contractor.

e. Scheduled delivery date.

(NOTE): No applications for payment will be processed unless the above listed information has been submitted.

B. SHOP DRAWINGS

1. Scale and Measurements: Make Shop Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work.

2. Types of submittals required:

a. Submit Shop Drawings in the form of two (2) prints of each sheet and one (1) digital copy to Architect and Engineer.

b. Submit two (2) copies of all supporting documentation including manufacturer's data, installation requirements, dimensional information, and any other required information to determine if a product meets the intent of the specification.

3. Review comments of the Architect will be made to all copies when it is returned to the Contractor. The Contractor may make and distribute such copies as are required for his purposes.

C. MANUFACTURER'S LITERATURE

1. Where contents of submitted literature from manufacturers include data not pertinent to the submittal, clearly show which portions of the contents are being submitted for

review.

D. SAMPLES

1. Provide Sample or Samples identical to the precise article proposed to be provided. Identify as described under "Identification of Submittals" below.

2. Number of Samples required:

a. Unless otherwise specified, submit samples in the quantity which is required to be returned, plus two (2) which will be retained by the Architect.

b. By prearrangement in specific cases, a single sample may be submitted for review and, when approved, be installed in the Work at a location agreed upon by the Architect.

E. COLORS AND PATTERNS

1. Unless the precise color and pattern is specifically called out in the Contract Documents, and whenever a choice of color or pattern is available in the specified products, submit accurate color and pattern charts to the Architect for selection.

1.2 SUBMISSION PROCEDURE

A. IDENTIFICATION OF SUBMITTALS

1. Multiple submittals on a single transmittal are not acceptable. Accompany each submittal with a letter of transmittal showing all information required for identification and checking.

2. All submittals will be consecutively numbered.

a. When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new transmittal number.

b. On re-submittals, cite the original submittal number for reference.

3. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.

4. Maintain an accurate submittal log for duration of the Work, showing current status of all submittals at all times. Make the submittal log available to the Architect for their review, upon request.

B. GROUPING OF SUBMITTALS

1. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.

a. Partial submittals will be rejected as not complying with the provisions of the Contract.

b. The Contractor may be held liable for delays so occasioned.

2. Provide a separate transmittal and drawing number for each item to be reviewed.

C. CHECKING SUBMITTALS PRIOR TO SUBMISSION

1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.

2. Verify that each item and the submittal for it conform in all respects with the specified requirements.

3. The drawings submitted shall be marked with the name of the project, numbered consecutively and bear the signed and dated stamp of the approval of that Contractor as evidence that the drawings have been checked by the Contractor. Any drawings submitted without this stamp of approval will not be considered and will be returned to the Contractor for re-submission. If the shop drawings show variation from the requirements of the Contract because of standard shop practice or with reasons, the Contractor shall make specific mention of such variations in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment; otherwise, that Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract even though such shop drawings have been approved.

D. DELIVERY AND TIMING OF SUBMITTALS

1. All submittals shall be transmitted to the Architect/Engineer for review based upon their relative position in the Construction Schedule, or as follows:

   a. Prior to Mobilizing On-Site
      1. Bonds
      2. Insurance Certificate

   b. Following Notice to Proceed; **NOTE TIME FRAMES INVOLVED**
      1. Shop Drawing Submittal Schedule (within 10 days)
      2. Schedule of Values (within 10 days)
      3. Superintendent's Resume (within 10 days)
      4. Detailed Construction Schedule (within 10 days) updated monthly
      5. Subcontractor Listing (within 10 days) updated monthly
      6. All Shop Drawings/Submittals (within 3 months) unless otherwise approved

2. Shop drawing submittals shall be made far enough in advance, based on the approved Construction Schedule, to meet all installation dates as scheduled. This will require that sufficient lead time be allowed to address an adequate review period, securing necessary approvals, possible revisions and re-submittals, placing orders and securing delivery dates.

3. In scheduling, allow at least ten (10) working days for review by the Architect following his receipt of the submittal (plus transit time).

E. ARCHITECT'S REVIEW

1. Review by the Architect does not relieve the Contractor from responsibility for errors which may exist in the submitted data.

2. The review of Shop Drawings will be general and shall not be construed as:
   a. Permitting any departure from the Contract Requirements.

   b. Relieving the Contractor of the responsibility for any error in details, dimensions or otherwise that may exist.

c. Approving departures from additional details or instruction previously furnished by the Architect/Engineer.

3. Revisions:

a. Make revisions required by the Architect.

b. If the Contractor considers any required revisions to be a change, he shall notify the Architect as provided for in Specification Section 01 26 53.

c. Make only those revisions directed or approved by the Architect.

4. If a drawing, as submitted, indicates a departure from the Contract requirements which the Architect/Engineer finds to be in the interest of the Owner and to be minor as not to involve a change in the Contract Price or time for performance, the Architect/Engineer may approve the drawing.

F. FINAL DISTRIBUTION OF SUBMITTALS

1. Each Contractor shall be responsible for the distribution of the Shop Drawings and schedules within his own organization and to his subcontractors.

END OF SECTION

ELECTRONIC FILE AGREEMENT

PROJECT NAME: EMERALD HIGH SCHOOL – ADDITIONS & RENOVATIONS

GREENWOOD SCHOOL DISTRICT 50

JCS COMMISSION NUMBER: **22016**

DATE OF AGREEMENT:

ELECTRONIC FILES TO BE TRANSMITTED:

DELIVERED VIA: email

At your request, Jumper Carter Sease/Architects PA (JCS) will provide electronic files for your convenience and use related to the project noted subject to the following terms and conditions. By your signature you agree to these terms and conditions.

1. JCS files are compatible with the software version they were created in. JCS makes no representation as to the compatibility of these files with other hardware or software used.
2. Data contained within the electronic files are part of JCS's instruments of service and shall not be used by anyone receiving this data for purposes other than as a convenience in the preparation of work for the subject project. Any other use or reuse is strictly forbidden.
3. Purchaser agrees to indemnify and hold harmless JCS from all claims, damages, losses and expenses, including attorney's fees, arising from the use of the subject files.
4. The electronic files are not contract documents. By use of the electronic files, purchaser is responsible for complying with the contract documents including but not limited to the need to check, confirm and coordinate all dimensions and details, field measurements, verification of field conditions and coordination of work with others.
5. The Architect's title block or other information identifying the Architect or the Architect's professional consultants will not be provided on the electronic files and this agreement grants no right to reproduce or otherwise utilize such information.
6. JCS may require a service/handling fee prior to delivery of the requested electronic files.
7. Under no circumstances shall delivery of the electronic files for use be deemed a sale by JCS, and JCS makes no warranties, either expressed or implied, of merchantability and fitness for any particular purpose. In no event shall JCS be liable for any loss of profit or any damages. Purchaser acknowledges and assumes all such risks.
8. Electronic files are in REVIT 2020 format.

ELECTRONIC FILE AGREEMENT

PROJECT NAME: EMERALD HIGH SCHOOL – ADDITIONS & RENOVATIONS
GREENWOOD SCHOOL DISTRICT 50

JCS COMMISSION NUMBER: 22016

Item	Sheet Name	Drawing Number

IN WITNESS WHEREOF, THE Engineer and Purchaser have caused this Agreement to be executed by their duly authorized representatives, as of the date set forth above.

ARCHITECT: Jumper Carter Sease/Architects, P.A.

By: _____

Title: _____

Date: _____

Email: _____

Signature: _____

PURCHASER: _____

By (print name): _____

Title: _____

Date: _____

Email: _____

Signature: _____

Make checks payable to "Jumper Carter Sease/Architects PA." The service/handling fee for the files is One Hundred Fifty Dollars, ($150.00).

Signed electronic file agreement and check can be mailed to:

Jumper Carter Sease, PA
412 Meeting Street
West Columbia, South Carolina 29169

Electronic files are available for the above project. The files will be either emailed or burned on a CD depending on the contractor's preference. **NO FILES WILL BE TRANSFERRED WITHOUT FIRST** receiving a signed copy of the electronic file agreement and a check or cash money for the full amount shown on the electronic file agreement.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. This Section includes administration and procedural requirements for compliance with the 2018 IBC, Chapter 1 Inspections and Chapter 17 Special Inspections.

C. South Carolina Office of School Facilities (OSF) – “INSPECTION PROGRAM MANUAL”, latest edition.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other qualityassurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Pre-construction Conference: Upon receipt of the “Notice-to-Proceed” and prior to the start of construction, the contractor shall conduct a Pre-construction Conference. It is the responsibility to notify the architect of the date and time of this conference in a timely manner so that the architect can notify the Office of School Facilities (OSF). A representative from OSF along with representatives from the testing company(ies) and the Chapter 1 and Chapter 17 inspection agencies must be present.

D. Related Sections include the following:

1. Division 1 Section "Construction Progress Schedule" for developing a schedule of required tests and inspections. The special inspector shall continually coordinate with the Architect for the time and requirements of required inspections.
2. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
3. Divisions 2 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Agency Approval: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by South Carolina Office of School Facilities (OSF).

B. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

C. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

D. Delete first paragraph below if Project does not require mockups. Revise if any mockups are to be constructed at an off-site location.

E. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

F. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

G. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

H. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

I. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

J. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

K. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

L. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

M. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

C. The special inspector's reports and testing agencies results shall have precedence over reports and test results provided by the contractor.

D. Where conflict exists between the construction documents and approved shop drawings submittal data, the construction documents shall govern unless the shop drawing/submittal data are more restrictive. All conflicts shall be brought to the attention of the architect.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Recognized Agency: For the purposes of this work, only companies utilizing **certified inspectors as designated by the South Carolina Office of the State Engineer or Office of School Facilities** will be accepted for these special inspections. These Companies are listed on their web site however may not be current. Documentation of the individual's certificates scheduled to perform inspections for this project must be submitted for review by the architect prior to award of this work.

C. Special Inspectors shall keep and distribute records of inspections. The special inspector shall furnish inspection reports to OSF, contractor, architect and owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of OSF and to the architect prior to the completion of the phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and OSF. Prior to the start of work.

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

E. Reports: Prepare and submit certified written reports that include, but are not limited to, the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

Sample forms required for use by OSF are indicated in section 3.4 Testing and Inspection Log and Forms located toward the end of this specification.

F. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
a. Allow seven (7) days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 33.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least Forty-Eight (48) hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
6. The contractor shall be responsible for costs of: Re-testing and re-inspection of materials, work and/or products that do not meet requirements of the construction documents and shop drawings/submittal data.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with the Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar qualitycontrol service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar qualitycontrol services required by the Contract Documents. Submit schedule within thirty (30) days of date established for commencement of the Work the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Shall be as listed herein.
B. Special Tests and Inspections: Conducted by a qualified **special inspector designated by the South Carolina Office of School Facilities (OSF)** as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ACCEPTABLE TESTING AGENCIES
Acceptable companies shall be as designated by the South Carolina Office of School Facilities (OSF).

3.2 SPECIAL INSPECTIONS REQUIRED CHAPTER 17:

A. Seismic Design Category: The Seismic Design Category for this project is "**B**".

B. Facility Classification: As stated in Section 1604.5 of the 2018 IBC, this facility is classified as a "Non-Essential Facility".

C. IBC 2018 Chapter 17 Inspections, INCLUDE BUT ARE NOT LIMITED TO THE FOLLOWING:

2018 IBC Chapter 17 Statement of Special Inspections EMERALD HIGH SCHOOL ADDITIONS & RENOVATIONS – GREENWOOD SCHOOL DISTRICT 50						
Material/Activity	Type of Inspection	Req'd		Inspection /Testing By:		
		For IBC Proj.	Ref. Section or A/E Specs	Owner's Special Insp	Owner's Test Lab	Contractor / Supplier
SPECIAL INSPECTIONS						

Seismic	Seismic Systems Seismic force resisting systems	X	1705.11 1705.12		X		
Wind	Wind Requirements	X	1705.10		X		
Structural Observation:							
Seismic	Seismic Design D, E, or F and Risk Category III		1704.5.2 1705.11.4			Seismic	
Wind	V_{asd} per 1609.3.1 exceeds 110 mph and Category III	X	1704.5.2		X	Wind	
Foundations:							
Soil	Compaction of Fill Materials	X	Specs. 1705.6			X	
Soil	Bearing at Bottom of Footing Excavations	X	Specs			X	
Reinf. Bars	Size and Placement in		ACI, Specs				
	Foundations	X		5	X		
Concrete Construction:							
Concrete	Ready-mix Plant Quality Control	X	Specs	2			
Concrete	Mix Design Test and Certificates	X	Specs, 1705.3.1	X			
Reinf. Steel	Shop Drawings or Reinforcing Steel	X	Specs	X			
Reinf. Steel	Placement of Reinforcing Steel	X	TABLE 1705.3	5	X		
Reinf. Steel	Welding	X	TABLE 1705.3	2	X		
Formwork	Design, Placement, & Shoring	X	TABLE 1705.3		X		
Formwork	Removal and Reshoring	X	TABLE 1705.3				
Concrete	Test Cylinders	X	TABLE 1705.3	4		X	

Concrete	Mix proportions & Mix on Delivery Tickets	X	TABLE 1705.3 AND SPECS			X	
Concrete	Slump Test	X	1 TABLE 1705.3 AND SPECS	4		X	X
Concrete	Placement Procedures	X	*1905.9, 1905.10*	5	X		
Concrete	Curing Temperatures & techniques	X	1905.11		X		

Anchors	Anchors cast in concrete				X		
MASONRY CONSTRUCTION:							
Inspection Level	Indicate level of Inspection Required	X	Table 1705.6		X		
Quality Assurance	Indicate level of Quality Assurance Required	X	1705.4		X		
Clay Masonry	Certificate, Tests & Technical Data	X	1705.4,	X			
Concrete Masonry	Certificate, Tests & Technical Data	X	1705.4,	X			
Reinf. Steel	Shop Drawings	X	Specs	X			
Reinf. Steel	Condition, Size, Location, Spacing of Reinf. Steel	X	1705.2.2.1.2		X		
Anchors	Manufacturer's Data	X	1705.4	X			
Accessories	Manufacturer's Data	X	Specs	X			
Mortar & Grout	Mix Design & Data	X	1704.5	X			
Masonry Panel	Masonry Strength		1705.4	2, 4			
Mortar & Grout	Field samples & testing	X	1705.4	4		X	
Foundations Elements	Quality assurance	X	1705.4	5	X		
Masonry	Placement of units, mortar & accessories	X	1705.4	5	X		
Masonry	Protection of masonry work	X	1705.4	5	X		
Anchorage	Placement of devices	X	1705.4	5	X		
Seismic	Reinforcing (Seismic Design Category "C")	X			X		

STEEL CONSTRUCTION:							
Fabricator	Inspection of Fabricators	X	1704.2.5	2			X, 1
Fasteners	Mfr's Certificate of Compliance	X	1704.3	X			3
Structural Steel	AISC 360	X	1705.2.1 and Table 1705.2.2	2	X		3
Welding	AWS D1.3 AWS D1.4 ACI 318	X	Per Table 1705.2.2	X	X		3
Details	Shop Drawings Review	X	Specs	X	X		
Erection	Installation of High Strength Bolts	X	1704.3.3		X		
Erection	Welding	X	1704.3.1, 1707.2		X		
Erection	Steel Framing & Connections	X	1704.3.2	5	X		
Seismic	Structural Steel	X	1707.2, 1708.4	2, 5	X		
Seismic	Cold-formed Framing – Connections	X	1707.4		X		
Quality assurance	AISC 341		1705.12.2				
ADDITIONAL SEISMIC INSPECTIONS:							
Components	Storage Racks	X	1705.11		X (Spot)		
Components	Architectural Exterior Cladding (SDC = B)	X	1705.11.5		X (Spot)		
Components	Mechanical & Electrical – Anchorage (SDC =C)	X	1705.11.6		X		
Components	Acoustical Ceilings	X	ASTM E 580	5	X		3
SPRAYED FIRE-RESISTANT MATERIALS							
Spray-on	Manufacturer's data		Specs and 1705.13.1	X			3

Spray-on	Surface conditions		1705.13.2 Mnfgr written instruction			X	
Spray-on	Application		1705.13.2 Mnfgr. Written instruction			X	3
Spray-on	Thickness		1705.13.2 Mnfgr. Written instruction			X	
Spray-on	Density		1705.13.5			X	
			Mnfgr. Written instruction				
Spray-on	Bond Strength		1705.13.6 Mnfgr. Written instruction			X	3
Mastic, Intumescent Coatings	Per AWCI		SPECS 1705.14		X		
GWB Fireproof	Manufacturer's data	X	Specs	X			
GWB Fireproof	Placement of materials	X	Specs		X		3
Firewall Assembly	Manufacturer's data	X	Specs	X			
Firewall Assembly	Placement of materials	X	Specs		X		
SMOKE CONTROL:							
Ducts	Device location and air duct leakage	X	1705.17				X, 7
System	Pressure difference, flow measurements, & detection testing	X	1705.17				X, 7
Controls	Activation sequence	X	1705.17				X, 7
FIRE-RESISTANT PENETRATION AND JOINTS							
Penetrations and Joints	For Risk Category III	X	1705.16		X		

Special Inspection Notes:

1. Fabricator, supplier, ready-mixed plant and all other similar plants shall provide certificates, prior to fabrication and submitted with shop drawings, from an approved independent inspection, testing or other quality assurance agency attesting that the plant meets at least one of the following criteria:

   a. The plant is a certified production plant meeting the quality assurance standards of a recognized national standards organization.
   b. The plant maintains an agreement with an independent inspection or quality assurance agency to conduct periodic in-plant quality assurance inspections. The frequency of these inspections shall not be less than one every six months.
   c. The plant has an in-shop quality assurance inspection program by an independent testing or quality assurance agency for the work/product to be provided on this project.
2. The Architect and Engineer shall review fabricator/supplier/producer certificates of conformance with appropriate standards of practice and quality assurance.
3. Contractor/supplier shall submit manufacturer's certificate of compliance for the materials/products.
4. Reviews records and test results for conformance for the materials/products.
5. Observes placement and erection of materials during jobsite visits.
6. Unless otherwise noted, the reference numbers listed refer to the 2018 International Building Code (2018 IBC)
7. Special inspection firm shall have expertise in fire protection engineering, mechanical engineering, and certification as an air balancer.

3.3 INSPECTIONS REQUIRED CHAPTER 1:

A. IBC Chapter 1 Inspections

1. Chapter 1 Inspections for this project shall be provided by individuals approved by Office of School Facilities. The required Inspections for this project include but are not limited to: 109.3.2 Concrete slab or under floor inspection 109.3.3. Lowest floor elevation.

109.3.4 Frame inspection.

1093.5 Lath or gypsum board inspection.

109.3.6 Fire-resistant penetrations.

109.3.7 Energy efficiency inspections.

909.3 Special inspection and test requirements (smoke control system)

S406.6 Inspection of fill. Placement of the fill material shall be inspected by the code official.

RR109.1.1. Foundation inspection: Inspection of the foundation shall be made after poles or piers or trenches or basement areas are excavated and any required forms erected and any required reinforcing steel is in place prior to the placing of concrete. The foundation inspection shall include excavations for thickened slabs intended for the support of bearing walls, partitions, structural supports, or equipment.

RR109.1.2 Plumbing, mechanical, gas and electrical systems inspection: Rough inspection of plumbing, appliances are set or installed, and prior to farming inspection.

Mechanical Code: M107.1 Required Inspections

1. Underground inspection shall be made after trenches or ditches are excavated and bedded, piping installed, and before backfill is put in place.
2. Rough-in inspection shall be made after the roof, framing, fireblocking, and bracing are in place and all ducting and other components to be concealed are completed, and prior to the installation of wall or ceiling membranes.

Plumbing Code: P107.1 Required Inspection and testing.

1. Underground inspection shall be made after trenches or ditches are excavated and bedded, piping installed, and before backfill is put in place.
2. Rough-in inspection shall be made after the roof, framing, fireblocking, and bracing are in place and all ducting and other components to be concealed are completed, and prior to the installation of wall or ceiling membranes.

Electrical Code:

1. Underground inspection shall be made after trenches or ditches are excavated and bedded, piping installed, and before backfill is put in place.
2. Rough-in inspection shall be made after the roof, framing, fire-blocking, and bracing are in place and all ducting and other components to be concealed are completed and prior to the installation of concealing construction.

3.4 TEST AND INSPECTION LOG AND FORMS

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours

C. Maintain all logs, inspection reports and related summary sheets as required by Office of School Facilities (OSF). Samples of the required inspection documentation forms from the OSF Inspection Program Manual. The contractor, testing agency and inspectors are required to be familiar with the required forms as well as the current **"INSPECTION PROGRAM MANUAL".**

This manual along with the current OSF required inspection forms are available on line at the South Carolina Department of Education web site under Office of School Facilities.

3.5 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

3.6 TESTING AND INSPECTON

A. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings and to satisfy IBC requirements for Chapter1 Inspections and Chapter 17 Special Inspections.

END OF SECTION

CONTRACTOR'S STATEMENT OF RESPONSIBILITY

Seismic Quality Assurance Plan

To be completed by the General Contractor and every Subcontractor responsible for the construction of a designated systems and components listed in the Seismic Quality Assurance Plan. Form is to be submitted to Architect prior to the installation of seismic systems and a copy be available at the final inspection for review of the Authority having Jurisdiction.

Project:	EMERALD HIGH SCHOOL – ADDITIONS & RENOVATIONS
Architect's Commission Number:	22016
Owner:	Greenwood School District 50 1855 Calhoun Road Greenwood, South Carolina 29649
Phone:	(864) 941-5400
Contact Person:	Mr. Rodney Smith

A Seismic Quality Assurance Plan as required by Section 1704 of the 2018 International Building Code has been defined for this project. The requirement for the Contractor's Statement of Responsibility is required in Section 1704.4 of the IBC.

As a Contractor responsible for the construction of designated seismic force resisting systems and components listed in the quality assurance plan, I acknowledge the following:

1. We acknowledge awareness of the special requirements contained in the quality assurance plan.
2. We acknowledge that control will be exercised to obtain conformance with the construction documents approved by the Building Official.
3. We acknowledge that procedures will be maintained for exercising control within our organization to ensure compliance with the seismic design shop drawings and submittals submitted by our company and reviewed and noted by the Architect/Engineer of Record.
4. Person(s) in our organization exercising control of the quality assurance plan requirements and their qualifications are identified below. (if needed attach additional list of personnel with qualifications.)

Submitted by:

_____	_____
(Type or Print Firm name)	(Type or Print Name of Firm Owner, Partner or Corporate Secretary)
_____	_____
_ Signature	Date (Corporate Seal)

Owner's Authorization:

_____	_____
_ Signature	Date

Building Official's Acceptance:

_____	_____
_ Signature	Date

PART 1 - GENERAL

1.1 DESCRIPTION

A. Throughout the Project Documents, reference is made to specifications and standards issued by nationally recognized professional and/or trade organizations.

1. Unless otherwise specifically stated, all manufacturer's catalogs, specifications, instructions or other information or literature that are referred to in the specifications shall be considered as the latest edition and/or revision of such publication that is in effect on the date of the Invitation or Advertisement for Bids.

2. When standard specifications such as the American Society for Testing and Materials, Federal specifications, Department of Commerce (Commercial Standards), American Institute of Steel Construction, or other well-known public or trade associations, are cited as a standard to govern materials and/or workmanship, such specifications or portions thereof as referred to shall be equally as binding and have the full force and effect as though it were copied into these specifications. Such standards as are mentioned are generally recognized by and available to the trades concerned. The Program Manager will, however, upon request of a bidder or Contractor, furnish for inspection a copy of any standard specifications mentioned or direct the bidder or Contractor to an easily available copy. Unless otherwise specifically stated, the standard specifications referred to shall be considered as the latest edition and/or revision of such specifications that is in effect on the date of the Advertisement for Bids. In case of any conflicts between standard specifications and the written portion of the Specifications, the specifications as actually written herein will govern.

3. The referenced standards are generally identified by abbreviating the name of the organization following with the specification/standard number.

4. Unless specifically indicated otherwise, all references to standards refer to the latest edition available at the time of bidding.

1.2 ABBREVIATIONS

A. Wherever the following abbreviations are used in these Project Documents, they are to be construed the same as the respective expressions represented:

AASHO	American Association of State Highway Officials
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AGA	American Gas Association
AI	Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ALS	American Lumber Standards
ANSI	American National Standards Institute, Inc.
APA	American Plywood Association
ARI	Air Conditioning and Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers

ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing Materials
AWI	Architectural Woodwork Institute
AWWA	American Water Works Association
AWPA	American Wood Preservers Association
AWS	American Welding Society
BIA	Brick Institute of America
CE	Corps of Engineers
CISPI	Cast Iron Soil Pipe Institute
CRSI	Concrete Reinforcing Steel Institute
CTI	Ceramic Tile Institute of America
DOT	Department of Transportation
EPA	Environmental Protection Agency
FSS	Federal Specifications and Standards, General Services Administration
GA	Gypsum Association
IEEE	Institute of Electrical and Electronics Engineers
MBMA	Metal Building Manufacturer's Association
MCAA	Mechanical Contractors Association of America
MFMA	Marble Flooring Manufacturers Association
MIA	Marble Institute of America
ML/SFA	Metal Lath/Steel Framing Association
NAAMM	National Association of Architectural Metal Manufacturers
NAPA	National Asphalt Pavement Association
NBHA	National Builders Hardware Association
NCMA	National Concrete Masonry Association
NEC	National Electric Code (Now NFPA)
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NPCA	National Paint and Coating Association
NRCA	National Roofing Contractors Association
NTMA	National Terrazzo and Mosaic Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Pre-stressed Concrete Institute
SDI	Steel Deck Institute
S.D.I.	Steel Door Institute
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPIB	Southern Pine Inspection Bureau
SSPC	Steel Structures Painting Council
TCA	Tile Council of America, Inc.
UL	Underwriters Laboratories, Inc.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products. B. Related Sections include the following:

1. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from that required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:
   a. Specification Section number and title.
   b. Generic name used in the Contract Documents.
   c. Proprietary name, model number, and similar designations.
   d. Manufacturer's name and address.
   e. Projected delivery date or time span of delivery period.
   f. Identification of items that require early submittal approval for scheduled delivery date.
3. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
4. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections

and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form provided by the Construction Manager / Architect.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
   g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction, where available for type of material proposed.
   i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
   j. Cost information, including a proposal of change, if any, in the Contract Sum.
   k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
   l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later. a. Form of Acceptance: Change Order.
   b. Use product specified if Architect cannot decide on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
   a. Form of Approval: As specified in Division 1 Section "Submittal Procedure."

b. Use product specified if Architect cannot decide on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedure." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions. B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected. C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.

D. Material Moisture and Mold Control: Comply with recommendations contained in Associated General Contractors (AGC) document "Managing the Risk of Mold in the Construction of Buildings." Prepare and submit plan for protecting materials from water damage, including the following:

1. Indicate delivery, checking and storage operations affected by water damage control efforts.
2. Indicate procedures for protecting porous materials from water damage, and how damaged materials will be handled.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet work has dried sufficiently to permit installation of related finish materials.

4. Describe protocol for dealing with large and unexpected water intrusion into completed portions of building. Indicate procedures for investigation of cause and effects, and methods for dealing with both.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Close-out Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product. B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product match.
    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Requests for substitution following award of contract must comply with requirements of this article and are restricted to those necessitated by the following circumstances:
    1. Specified product is no longer available for purchase.
    2. Specified product is not available within schedule requirements of project.
    3. Specified product is not compatible with other product approved for project.
    4. Specified warranty is not available.

B. Timing: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

C. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied and so certified by Contractor. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    1. Requested substitution does not require extensive revisions to the Contract Documents.

2. Requested substitution is consistent with the Contract Documents and will produce indicated results.
3. Substitution request is fully documented and properly submitted.
4. Requested substitution will not adversely affect Contractor's Construction Schedule.
5. Requested substitution has received necessary approvals of authorities having jurisdiction.
6. Requested substitution is compatible with other portions of the Work.
7. Requested substitution has been coordinated with other portions of the Work.
8. Requested substitution provides specified warranty.
9. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION

PART 1 - GENERAL

1.1 Description

A. Work included: This Section establishes general requirements pertaining to cutting (including excavating), fitting and patching of the work required to:

1. Make the several parts fit properly;

2. Uncover work to provide for installing, inspection, both, of ill-timed work;

3. Remove and replace work not conforming to requirements of the Contract Documents; and

4. Remove and replace defective work. B. Related Work:

1. Documents affecting work of this section include, but are not necessarily limited to, the contract documents, addenda and General and Supplementary Conditions.

2. In addition to other requirements specified, upon the Construction Managers and/or Architect's request to uncover work to provide for inspection by the Construction Manager and/or Architect of covered work, and remove samples of installed materials for testing.

3. Do not cut or alter work performed under separate contracts without the Construction Manager's and Architect's written permission.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

1.3 SUBMITTALS

A. Request for Architect's consent:

1. Prior to cutting which effects structural safety, submit written request to the Architect for permission to proceed with cutting.

2. Should conditions of the Work, or schedule indicate a required change of materials or methods for cutting and patching, so notify the Architect and secure his written permission and the required Change Order prior to proceeding. B. Notices to the Architect:

1. Prior to cutting and patching performed pursuant to the Architect's instructions, submit cost estimate to the Architect. Secure the Architect's approval of cost estimates and type of reimbursement before proceeding with cutting and patching.

2. Submit written notice to the Architect designating the time the Work will be uncovered, to provide for the Architect's observation.

2.1 MATERIALS

A. For replacement of items removed, use materials complying with pertinent Sections of these Specifications.

2.2 PAYMENT FOR COSTS

A. The Owner will reimburse the Contractor for cutting and patching performed pursuant to the written Change Order, after claim for such reimbursement is submitted by the Contractor and approved by the Architect. Perform other cutting and patching needed to comply with the Contract Documents at no additional cost to the Owner.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS A.

Inspection:

1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching and backfilling.

2. After uncovering the work, inspect conditions affecting installation of new work. B.

Discrepancies:

1. If uncovered conditions are not as anticipated, immediately notify the Architect and secure needed directions.

2. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION PRIOR TO CUTTING

A. Provide required protection including, but not necessarily limited to, shoring, bracing and support to maintain structural integrity of the Work.

B. Provide required fire protection including, but not necessarily limited to, fire blankets, fire extinguishing equipment.

3.3 PERFORMANCE

A. Perform required excavating and backfilling as required under pertinent other Sections of these Specifications.

1. Perform cutting and demolition by methods which will prevent damage to other portions of the Work and provide proper surfaces to receive installation of repair and new work.

2. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

3. All penetrations made by the Contractor through walls, ceilings, and/or floors shall be sealed by the Contractor to meet the requirements of all building codes, fire codes, applicable to this project.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous construction waste.
2. Recycling nonhazardous construction waste.
3. Disposing of nonhazardous construction waste. B. Related Sections:

1. Division 04 Section "Unit Masonry" for disposal requirements for masonry waste.
2. Division 04 Section "Architectural Cast Stone" for disposal requirements for excess stone and stone waste.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

Achieve end-of-Project rates for salvage/recycling of at least **75** percent by weight of total nonhazardous solid waste generated by the Work. Salvage/Recycle Goals: Owner's goal is to reuse, salvage and recycle as much nonhazardous demolition and construction waste as possible. Targeted Materials include the following:

a. Site-clearing waste.
b. Masonry and CMU.
c. Lumber.
d. Wood sheet materials.
e. Wood trim.
f. Metals.
g. Roofing.

h. Insulation.
i. Carpet and pad.
j. Gypsum board.

k. Piping.
l. Electrical conduit.
m. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates. 7) Plastic pails.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

50 CLEANING AND WASTE MANAGEMENT

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.3 RECYCLING CONSTRUCTION WASTE A.

Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.

4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Transport waste materials and dispose of at designated spoil areas on Owner's property.

E. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01 7419

CLOSE-OUT PROCEDURES

1.0 GENERAL

1.1 Deficiency Lists

A. During the construction of the work, the Architect/Engineer shall inspect the work for conformance to the Contract Documents.

B. Should an inspection reveal work that is not in conformance with the Contract Documents, and if the nature of the non-conformance warrants, at the sole discretion of the Architect/Engineer, a written list of deficiencies will be issued.

C. The "deficiency list" as hereinafter called, shall stipulate the item or items of work that are in non-conformance and shall specify a reasonable time for the deficient work to be brought into conformance with the Contract Documents.

D. Upon receipt of the deficiency list the Contractor shall by any and all means at his disposal, endeavor to correct the work within the time stipulated. The Contractor shall notify the Architect in writing when the work has been corrected and request an inspection.

E. If the inspection reveals the deficiency has been corrected, then the deficiency list shall be rescinded.

F. During the period that the deficiency list is in effect, the Architect may, at his option, not authorize the payment of progress billings until the deficiency list is rescinded.

1.2 Punch Lists/Final Inspection

A. When the Contractor determines that his work or portions of his work are sufficiently near completion to warrant a preliminary inspection, **he shall request in writing to the Architect a preliminary inspection.**

B. At a mutually agreed upon time, the Architect/Engineer and Contractor shall conduct a preliminary inspection of the work for completeness, conformance to the Contract Documents and compliance with applicable codes. Any items noted as incomplete shall be listed on a preliminary punch list, a copy of which shall be forwarded to the Contractor for completion and correction. If it is determined by the Architect that the work is not complete or sufficiently near completion, then the Contractor shall prepare his own preliminary punch list, forward copies to the Architect for review, and repeat Part A above.

C. The Architect shall establish a reasonable time period for the completion or correction of all items on the preliminary inspection punch list. All items on the preliminary punch list shall be completed **prior to inspection by State Agencies or Authorities Having Jurisdiction (AHJ).**

D. Any incomplete or non-compliance items found during the State Agency or AHJ inspection shall be completed by the Contractor within seven (7) days of the inspection or earlier if required by the Architect.

E. Upon completion of the State Agency or AHJ inspection list, and if the completeness of the work allows, the Architect/Engineer shall issue a Certificate of

Substantial Completion. Should the amount of incomplete work be such that a Certificate of Substantial Completion cannot be issued, the Contractor shall complete all remaining work and request in writing to the Architect a subsequent inspection for Substantial Completion.

F. Once a Certificate of Substantial Completion has been issued, a final inspection shall be held with the Owner, Architect/Engineer, Architect and Contractor. Any items noted during the final inspection will be documented in a final inspection punch list and forwarded to the Contractor for completion. All final inspection punch list items shall be completed with fourteen (14) days of receipt of the final inspection punch list. Once all final punch list items are complete, the Architect/Engineer shall establish the date of final completion.

1.3 Project Close-Out

A. Final Close-Out and Payment

1. The Contractor may make Application for Final Payment after the Certificate of Substantial Completion has been issued. The following items must be submitted to the Architect prior to processing of the Final Application for Payment:

   a. Affidavit of Payment of Debts and Claims, (AIA-G706);
   b. Consent of Surety, (AIA-G707);
   c. Release of Liens, (AIA-G706A) from: Contractors, Sub-Contractors, and Material Suppliers;
   d. Letter on company letterhead stating all temporary facilities, services, debris and surplus materials have been removed;
   e. Final "Project Record Documents" as specified in Section 01 78 39, Project Record Documents;
   f. Operations & Maintenance Manuals as specified in Section 01 78 39, Project Record Documents;
   g. Final topographical survey as required by 01 73 00;
   h. Guarantees, Warranties, and Bonds as specified in Section 01 78 39, Project Record Documents;
   i. Spare parts and replacement items as required by the Specifications;
   j. Letter on company letterhead stating no asbestos containing material has been installed in the project;
   k. Executed Certificate of Substantial Completion;
   l. Demonstration, testing and training of equipment is completed;
   m. Completed final inspection punch list signed by the Contractor verifying that each item is complete.

2. **No final payment application will be processed for payment until final inspection and final acceptance.**
3. Close-out time encompasses a large amount of work during a short period of time. Therefore, the Contractor is encouraged to begin to submit closeout items as soon as possible so that the Contract may be completed, thus allowing the Architect/Engineer to recommend approval of the final payment to the Owner.

4. The Architect may continue to withhold no less than 5% retainage from the

Contractor until all outstanding close-out materials are submitted. It shall

be at the discretion the Architect, to reduce the amount of retainage on a project by project basis, upon a favorable review of the status of completion of the final punch list, the status of close-out submittals, and above all, the total amount listed on the Release of Liens submitted by the Contractor for all SubContractors and Material Suppliers contracted with by the General Contractor. At no time shall the retainage be reduced to an amount less than the total of the Release of Liens submitted by the Contractor. Final payment may then be made once all remaining outstanding close-out requirements are met.

1.4 Responsibility

A. It shall be the Contractor's responsibility to see that all requirements of this Section of the Specifications are executed and complete in a timely manner.

B. No provisions of this section of the Specifications shall in any way relieve the Contractor of completing his work on time and in accordance with the Project Schedule.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included:

1. Throughout progress of the Work, maintain an accurate record of changes in the Contract Documents, as described in Paragraph 2.1 below. Upon completion of the Work, deliver the recorded changes to the Architect.

2. Final record survey, performed by a Professional Land Surveyor, of installed underground materials and final grades.

3. To aid in the continued instruction of operating and maintenance personnel, and to provide a positive source of information regarding the products incorporated into the Work, furnish and deliver the operation and maintenance manuals and data as described in this Section and in other pertinent sections of these Specifications.

4. Compile specified guarantees, warranties and bonds, as well as specified service and maintenance contracts. Co-execute submittals when so specified and review submittals to verify compliance with Contract Documents. Submit to Architect for review and transmittal to Owner.

B. Related work:

1. Documents affecting work of this section include, but are not necessarily limited to, the contract documents, addenda and General and Supplementary Conditions.

2. Other requirements affecting Project Record Documents may appear in pertinent other Sections of these specifications.

3. Documents affecting the various warranties required:

a. General Warranty of Construction: General Conditions of the Contract.

b. Warranties, Guarantees, & Bonds Required for Specific Products: Each respective section of Specifications as listed in the Project Manual.

c. Provision for Duration of Warranties Guarantees, & Bonds: The respective section of specifications which specifies the product.

1.2 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of Record Drawings to one person on the Contractor's staff as approved by the Architect/Engineer.

B. In preparing operation and maintenance manuals and data required by this Section, use only personnel who are thoroughly trained and experienced in operation and maintenance of the described items, completely familiar with the requirements of this Section, and skilled in technical writing to the extent needed for communicating the essential data.

 C. In preparing warranties, guarantees, and bonds, utilize personnel familiar with the requirements of the specifications regarding each. A detailed analysis of each specification is to be performed to assure all specified warranties, guarantees, and bonds are accounted for and submitted. D. Accuracy of records:

1. Accuracy of records shall be such that a future search for items shown on the Project Record Drawings may rely reasonably on the information provided under this Section of the Work.

1.3 SUBMITTALS

A. Project Record Drawings

1. The Architect/Engineer's approval of the current status of Project Record Drawings may be a prerequisite to the Architect/Engineer's approval of requests for progress payment and request for final payment under the Contract.

2. Prior to submitting each request for progress payment, secure the Architect/Engineer's approval of the current status of the Project Record Drawings.

3. Prior to submitting request for final payment, submit the final Project Record Drawings to the Architect/Engineer and secure his approval.

B. Operation and Maintenance Manuals

1. Comply with pertinent provisions of Section 01 33 00 Submittal Procedure.

2. Unless otherwise directed in other Sections, submit **TWO (2)** copies of the final Manual to the Architect prior to indoctrination of operation and maintenance personnel.

3. Submittals of approved copies of operation and maintenance data will be a prerequisite for approval of final payment applications.

C.Warranties, Guarantees and Bonds

1. Provide warranties, guarantees, and bonds as specified in Divisions 0133.

2. Unless otherwise directed in other Sections, or in writing by the Architect, submit two copies of each specified warranty, guarantee, and bond to the Architect.

3. Submittals of approved copies of warranties, guarantees, and bonds will be a prerequisite for approval of final payment applications

PART 2 - PRODUCTS

2.1 JOB SET RECORD DOCUMENTS

A. Promptly following receipt of the Owner's Notice to Proceed, obtain and provide, at no charge to the Owner:

1. One complete set of all Documents comprising the Contract, including Plans, Specification Manuals, and Shop Drawings.

2. Field survey books for use in staking sewer work.

B. Immediately upon receipt of the job set described in subparagraph 2.1.A.1 above, identify each of the Documents with the title, "RECORD DRAWINGS - JOB SET", and “RECORD SPECIFICATIONS - JOB SET”. C. Preservation:

1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Architect. Maintain the job set of Record Drawings completely protected from deterioration and from loss and damage until completion of the Work and transfer to the Architect.

2. In the event of loss of recorded data, use means necessary to again secure the data to the Architect/Engineer's approval.

   a. Such means shall include, if necessary in the opinion of the Architect/Engineer, removal and replacement of concealing materials.

   b. In such case, provide replacements to the standards originally required by the Contract Documents.

3. Do not use the job set for any purpose except entry of new data and for review by the Architect.

4. Maintain the job set at the site of Work that is designated by the Architect. D.

Making entries on Job Set Drawings:

1. Use erasable colored pencil, preferably red (not ink or indelible pencil) to delineate changes.

2. Show by station number location of all fittings, manholes, valves, wye locations, etc.

3. Reference all valves to above ground items deemed to be reasonably safe from being relocated and indicate such references on the drawings.

4. Show location of electrical conduit, pull boxes, etc.

5. Show all finish grades.
6. Note related Change Orders, Supplemental Instructions, Requests for Information on plan sheets where applicable.

7. Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual work performed in comparison with the text of the Specifications and modifications.

8. Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. E. Submittal:

1. Submit "marked-up" set of drawings to the Architect.

2. Make any necessary additions as required by the Architect.

3. Submit field survey books to the Architect.

4. Submit one complete set of Product Data (Shop Drawing) submittals. All submittals are to include approval stamp of Architect/Engineer.

2.2 OPERATION AND MAINTENANCE MANUALS

A. INSTRUCTION MANUALS: Where Instruction Manuals are required to be submitted under other Sections of these Specifications, prepare in accordance with the provision of this Section.

1. Format:

a. Size: 8-1/2" x 11"

b. Paper: White bond, at least 20 lb. weight

c. Text: Neatly written or printed

d. Drawings: 11" in height, preferable; bind in with text; foldout acceptable; larger drawings acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.

e. Flysheets: Separate each portion of the Manual with neatly prepared flysheets briefly describing contents of the ensuing portion; flysheets may be in color.

f. Binding: Use heavy-duty plastic or fiber

g. Measurements: Provide all measurements in U.S. standard units

 such as feet-and-inches, lbs, and cfm; where items may be expected to be measured within ten years in accordance with metric formula, provide additional measurements in the "International System of Units" (SI).

2. Provide front and back covers for each Manual, using durable material approved by the Architect, and clearly identified on or through the cover with at least the following information:

OPERATING AND MAINTENANCE INSTRUCTIONS

(name and address of work)

(name of Contractor)
(general subject of this manual)
(approval signature of Architect)
(approval date)

3. Contents: Include at least the following:

   a. Neatly typewritten index near the front of the Manual, giving immediate information as to location within the Manual of all emergency information regarding the installation.

   b. Complete instructions regarding the installation and maintenance of all equipment involved including lubrication, disassembly, and reassembly.

   c. Complete nomenclature of all parts of all equipment.

   d. Complete nomenclature and part number of all other data pertinent to procurement procedures.

   e. Copy of all guarantees and warranties issued.

   f. Manufacturer's bulletins, cuts, and descriptive data, where pertinent, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturer's data.

   g. Such other data as required in pertinent Sections of these Specifications.

4. Complete the Manuals in strict accordance with the approved preliminary drafts and the Architect's and Architect's review comments.

5. Any and all other items required by the specific specifications relating to the maintenance and operations of the various components of the work or any and all certificates and testing reports required by the specific specifications shall be incorporated into the maintenance manuals. Items of this nature shall include but are not limited to:

   a. Test and balance reports of HVAC systems.

   b. Test and certification reports of electrical systems such as fire alarm and life safety systems, communications systems, clock systems, etc.

   c. Valve tag lists

   d. Certification of sterilization of potable water systems.

B. MAINTENANCE TRAINING: Each Subcontractor shall instruct the Owner in the proper care, maintenance and operation of all systems installed under his Contract. Provide a written letter stating that the Owner has been instructed and list the following:

   1. Date, time and place of instruction

   2. Parties present

   3. Systems and items instructions were given on

2.3 WARRANTIES, GUARANTEES, AND BONDS

A. All work under this Contract shall be guaranteed by the Contractor against defects in material or workmanship for a period of one year from the Date of Substantial Completion, as established in writing by the Architect/Engineer, unless a longer

period is specified for a particular item of work in the specifications. In which case, the longer period shall be the Guarantee Period.

B. Prior to the end of the Guarantee Period, the Owner may have the Architect/Engineer inspect the Work, and shall advise the Architect/Engineer of any known defects. The Architect/Engineer or the Owner shall notify the Contractor, in writing, of any defects found.

C. The Contractor agrees to repair or replace all defects in material or workmanship within sixty (60) days of the date of the written notice from the Architect/Engineer or the Owner.

D. The Contractor shall furnish the Owner with three (3) copies of a written one-year guarantee delivered with the close-out documents, on the Contractor's stationery with original signatures on each copy, signed and sealed the same as the Bid Form, stating:

"The undersigned guarantees all work furnished by (Company Name) , for a period of one (1) year from the date of Substantial Completion, and agrees to repair or replace defects within sixty (60) days upon notice of defects by the Owner."

E. Submit warranties, bonds, service and maintenance contracts as specified in respective sections of Specifications.

1. Assemble warranties, bond and service and maintenance contracts, executed by each of respective manufacturers, suppliers, and subcontractors.

2. Number of original signed copies required: Two each.

a. Format:

1). Size 8-1/2 in. x 11 in., punch sheets for 3-ring binder.

2). Fold larger sheets to fit into binders.

3). Cover: Identify each packet with typed or printed title "GUARANTEES, WARRANTIES AND BONDS". List:

a). Title of Project

b). Name of Contractor

3. Binders: Commercial quality three-ring, with durable and cleanable plastic covers.

4. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

a. Product or work item.

b. Firm, with name of principal, address and telephone number.

c. Scope.

d. Date of beginning of warranty, bond or service and maintenance contract.

e. Duration of warranty, bond or service and maintenance contract.

f. Provide information for Owner's personnel:

1). Proper procedure in case of failure.

2). Instances which might affect validity of warranty or bond.

g. Contractor, name or responsible principal, address and telephone number.

F. For equipment or component parts of equipment put into service during progress of construction:

1. Submit documents within 10 days after inspection and acceptance.

2. Note: Warranty periods for equipment started during construction will not start until substantial completion for the project, including all HVAC equipment such as split system heat pumps, dehumidification equipment, exhaust fans, air handlers, etc.

G. Otherwise make submittals within ten days after Date of Substantial Completion, prior to final request for payment.

H. For items of work, where acceptance is delayed materially beyond Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

END OF SECTION

SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blastfurnace slag, and silica fume.

1.4 SUBMITTALS

A. General: Submit the following in accordance with conditions of the Contract and Division 1 Specification Sections.

B. Product Data: For each type of manufactured material and product, including forming and reinforcement accessories, admixtures, waterstops, joint systems, joint fillers, curing compounds, and others if requested.

C. Design Mixes: For each concrete mix.

1. Provide laboratory tests of materials and mix design tests.
2. Indicate amounts of mix water, if any, to be withheld for later addition at Project site.
3. For lightweight concrete mixes, indicate calculated equilibrium unit weight as determined by ASTM C 567, section 9.2.
4. Specify the location of the batch plant where the concrete will be mixed and the approximate distance from the job site.

D. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, spacings, bent bar diagrams, arrangement, and supports of concrete reinforcement.

E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Design and engineering of formwork are Contractor's responsibility.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar to that indicated for this Project with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Testing Agency Qualifications: An independent testing agency, acceptable to the Architect, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain each type of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each type of admixture from the same manufacturer.

E. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 318, "Building Code Requirements for Structural Concrete."
3. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material.

B. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

a. High-density overlay, Class 1, or better.
b. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, unless otherwise indicated.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no metal closer than 1 inch to the plane of the exposed concrete surface.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.

C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 SYNTHETIC MACRO FIBER REINFORCEMENT

A. Fibers shall be structural synthetic macro fibers complying with ASTM C 1116, Type III. Dosage rates shall be as indicated on the drawings or per the manufacturer's recommendation. In no case shall the dosage rate be less than 3.0 pounds per cubic yard for slabs on grade or 4.0 pounds per cubic yard for concrete slabs on composite steel deck. Fibers shall be UL certified for 2-hour minimum fire resistance when used in lieu of welded wire fabric in UL design series D700, D800 and D900 floor assemblies. Acceptable products include, but are not limited to:

1. Tuf-Strand SF, The Euclid Chemical Company.
2. Fibermesh 650, Propex Concrete Systems.
3. STRUX 90/40, Grace Concrete Products.

2.4 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

2. Precast concrete supports or concrete bricks may be used only for concrete members cast on earth. Reinforcement shall be wire-tied to these type supports periodically to prevent it from becoming dislodged during concrete placement.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 36. Cut bars true to length with ends square and free of burrs.

2.5 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. Cement shall contain no more than 0.60% total alkalis. B.

Fly Ash: ASTM C 618, Class C or F.

C. Normal Weight Aggregate: ASTM C 33.

D. Lightweight Aggregate: ASTM C 330.

E. Water: Potable and complying with ASTM C 94.

2.6 ADMIXTURES

A. General: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride. B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. Retarding Admixture: ASTM C 494, Type B.

E. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

F. High-Range Water-Reducing Admixture: ASTM C 494, Type F.

G. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.

H. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

2.7 WATERSTOPS

A. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch or 1/2 x 1 1/8 inch. Acceptable products include, but are not limited to:

1. Volclay Waterstop-RX, CETCO.
2. Swellstop, Greenstreak.
3. Hydro-Flex HF-302, Henry Company.

2.8 FLOOR AND SLAB TREATMENTS

A. Penetrating Liquid Floor Treatment: Chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

2.9 CURING MATERIALS

A. Contractor shall verify that curing and sealing materials applied to floor slabs are compatible with all floor stains, coatings, tile, and other finish materials.

B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

C. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry. (Burleen non-staining mats).

D. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B. Acceptable products include, but are not limited to:

1. 1100-CLEAR, W.R. Meadows, Inc.
2. W.B. Resin Cure, Conspec Marketing & Manufacturing Co., Inc.
3. KUREX DR VOX, Euclid Chemical.
4. CURE & SEAL WB, SpecChem.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.10 RELATED MATERIALS

A. Expansion and Isolation Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber. Thickness 1/2 inch unless otherwise indicated. Acceptable products include, but are not limited to:

1. Fibre Expansion Joint, W.R. Meadows, Inc. B.

Vapor Barrier: See Division 7 specifications.

C. Slab Granular Base Course: Clean crushed stone, crushed gravel, or manufactured or natural sand. Material shall be compactable. Rough or sharp materials which may puncture the vapor barrier shall not be used.

D. Dovetail Anchor Slots: Hot-dipped galvanized sheet steel, not less than 0.0336 inch thick with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

E. Latex Bonding Agent: ASTM C 1059, Type I or II, non-redispersible, acrylic emulsion or styrene butadiene.

F. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

G. Epoxy Anchoring Adhesive: ASTM C 881, two-component epoxy resin, supplied in manufacturer's standard side-by-side cartridge and dispensed through a mixing nozzle supplied by the manufacturer, of class and grade to suit requirements.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.12 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal weight structural concrete according to ACI 211.1 and ACI 301.
2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Maximum Unit Weight of Lightweight Concrete:

1. Calculated Equilibrium Unit Weight: 110 lb/cu. ft. plus or minus 3 lb/cu. ft., unless otherwise indicated, as determined by ASTM C 567, section 9.2.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent. E.

Maximum Slump:

1. Concrete containing high-range water-reducing admixture or plasticizing admixture: 8 inches, after admixture is added to concrete with verified slump of 2 to 4 inches.
2. Other concrete: 4 inches, plus or minus one inch.

F. 28-Day Compressive Strength: As indicated. Water-cementitious materials ratio shall not exceed 0.50 for slabs-on-grade and elevated slabs.

G. Air Content: In exterior concrete which is exposed to weather, add air-entraining admixture to result in concrete at point of placement having an air content of 5.5 percent within a tolerance of plus or minus 1.5 percent. Footings and other subterranean concrete do not require airentrainment.

H. Do not air entrain concrete in trowel-finished interior floors and suspended slabs except where air entrainment is required to achieve specified unit weights for lightweight concrete, or where a certain entrained air content is specified by the applicable UL fire-rated assembly. Do not allow entrapped air content in non-air-entrained concrete to exceed 3 percent.

I. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

J. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

B. In walls, slabs, and beams where runs of continuous bars too long to be fabricated from single bars, fabricate reinforcing so that lap splices in alternate bars are staggered.

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 11/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes. B. Job site mixing is not permitted.

C. Fiber Reinforcement: In concrete where fiber reinforcement is indicated, uniformly disperse synthetic fibers in concrete mixture.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class D, 1 inch for rough-formed finished surfaces which will be permanently concealed from view.

D. Construct forms tight enough to prevent loss or leakage of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1 vertical to 1.5 horizontal.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations. H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, water, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, and directions furnished with items to be embedded.
   1. Install anchor bolts, accurately located, to elevations required.

B. Conduits, Pipes, and Sleeves: Conduits are not permitted in elevated slabs or slabs on grade. Conduits, pipes and sleeves shall be permitted to be embedded in other concrete elements only with approval of the Structural Engineer. Embedded items must meet the following requirements:

   1. Conduits, pipes and sleeves shall be made only of materials not harmful to concrete. Aluminum is not permitted.
   2. Diameter of items shall not be larger than 1/3 the thickness of the wall, footing, or beam in which they are embedded.
   3. Items shall not be spaced closer than 3 diameters on center.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained. Retaining walls and basement

walls may not be backfilled until after 7 days minimum and after the concrete has achieved 100 percent of 28-day design compressive strength as verified by compression test results.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. In walls, slabs, and beams where runs of continuous bars too long to be fabricated from single bars, install reinforcing so that lap splices in alternate bars are staggered.

D. Before concrete is placed, accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. “Wet-sticking” of dowels, anchor bolts and reinforcing is not permitted. **Do not weld or tack weld reinforcing bars** unless indicated on the drawings or authorized by the Structural Engineer.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets so that length of overlap measured between outermost cross wires of each fabric sheet is not less than one spacing of cross wires plus 2 inches. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

G. Where blockouts are formed in slabs, unless otherwise indicated provide two #4 diagonal bars, 4'-0" long, at each corner of the blockout in the middle of the depth of the slab.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Provide construction joints at all locations where concrete placement is terminated resulting in concrete elements not being completed in a single monolithic placement. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Provide keys at construction joints using preformed galvanized steel or wood bulkhead forms, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Locate joints in continuous wall footings as required to facilitate construction.
6. In areas with terrazzo or hard tile, coordinate joint locations to match joints in terrazzo or tile.

C. Contraction (Control) Joints in Slabs on Grade: Construct contraction joints in slabs on grade to form patterns as shown. Use saw cuts 1/8 inch wide by one-fourth of slab thickness unless otherwise indicated.

1. Contraction joints shall be cut as soon as possible after slab finishing as may safely be done without dislodging aggregate or raveling joint edges. Joints shall be cut within 12 hours after concrete is placed.
2. If joint pattern is not shown, provide contraction joints at a maximum spacing of 15 feet in each direction. Locate to conform to bay spacing where possible (at column centerlines, half bays, third bays.)
3. In areas with terrazzo or hard tile, coordinate joint locations to match joints shown in terrazzo or tile.

D. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Use the manufacturer's approved adhesive for bonding to the hardened concrete. Install in longest lengths practicable. Tightly butt ends of waterstop together

to form a continuous waterstop. Locate waterstops so that there is a minimum of 3 inches of concrete on all sides of waterstop.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless water has been withheld from the mix for this purpose.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When the average daily outdoor temperature is expected to fall below 40 deg F for three successive days, or when freezing temperatures may occur during the first 24 hours after concrete placement, deliver and maintain concrete temperature within the temperature range required by ACI 306.1. The average daily outdoor temperature is the average of the highest and lowest temperature during the period from midnight to midnight.
2. Uniformly heat water and/or aggregates before mixing to obtain a concrete mixture temperature at point of placement within the temperature range required by ACI 306.1.

3. Temperatures specified to be maintained shall be those measured at the concrete surface, whether the surface is in contact with formwork, insulation, or air.
4. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
5. Do not use salt or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
6. **Do not use calcium chloride.**

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 95 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is included in calculation of total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

H. Blockouts in concrete walls to allow for erection of steel columns and beams shall be filled with concrete after the steel is erected and plumbed.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view, to receive a rubbed finish, or to be covered with a coating material applied directly to the concrete. This is the concrete surface imparted by selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

C. Rubbed Finish: Apply a grout-cleaned rubbed finish as follows to smooth-formed finished concrete where indicated. Rubbed finish shall be done when the air temperature is at least 40 deg F and rising. All finishing on an area shall be completed the same day it is started.

1. Surfaces to be grout cleaned shall be steel brushed to remove laitance and scale and to reveal partly obscured air bubble holes. Uneven form joints shall be ground smooth.
2. Combine one part portland cement to one and one-half parts fine sand by volume, with sufficient water to produce a grout having the consistency of thick paint. Blend standard and white portland cement in amounts determined by trial patches so that final color of dry grout will produce the color desired by the architect.
3. Thoroughly dampen concrete surfaces and cover with an application of grout.
4. Immediately after application of the grout, the surface shall be scoured with a cork float or other suitable material. This floating shall completely fill all holes and other irregularities in the surface.

5. When the grout is of such plasticity that it will not be pulled from the holes, remove excess grout by scraping and rubbing with a clean float of sponge rubber or burlap.
6. When the grout is thoroughly dry, the surface shall be vigorously rubbed with dry burlap to completely remove any dried grout. No visible film of dry grout shall remain.
7. Obtain approval of a sample area from Architect before proceeding with Work.
8. Final product shall be uniform in color and texture.
9. Keep surfaces damp for at least 36 hours after rubbing.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: All slabs shall first receive a float finish. Machine floating shall not be used until the concrete surface will support a finisher on foot without more than a 1/4 inch indentation.

C. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, wood flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, stain, or another thin film-finish coating system.

2. Slabs on grade which are scheduled to receive polished concrete shall receive a hard steel trowel finish (3 passes).

3. On lightweight concrete slabs containing entrained air, machine floating shall be started as late as possible and hard and prolonged troweling shall be avoided.

4. Finish surfaces to the following tolerances, according to ASTM E 1155:

   a. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for slabs-ongrade.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and to surfaces where terrazzo, ceramic or quarry tile is to be installed by thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiberbristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes, beam pockets, column pockets, and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.11 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305R for hotweather protection of concrete.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss exceeding 0.1 pounds per square foot per hour, based on chart in ACI 305R, before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall

within three hours after initial application. Maintain continuity of coating and repair damage during curing period of seven days.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period of seven days.

F. Remove curing and sealing materials from floor slabs, without damaging concrete surfaces, by method recommended by curing and sealing manufacturer after the curing period in areas where floor stains, coatings, tile, and other floor finish materials are to be applied if recommended by the floor finish manufacturer.

3.12 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 BONDING NEW CONCRETE TO EXISTING CONCRETE

A. At locations where new concrete is placed adjacent to existing concrete, unless indicated otherwise, clean and roughen the face of the existing concrete and provide a bonding agent in accordance with the manufacturer’s recommendations.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Concrete which will be exposed to view in the finished structure shall be restored to its original intended appearance or shall be removed and replaced. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension, down to solid concrete but not less than 1 inch in depth. Make edges

of cuts perpendicular to concrete surface. Clean, dampen with water, and brushcoat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at an inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness by using a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., plus one set for each additional 50 cu. yd. more than the first 25 cu. yd.

    a. When frequency of testing will provide fewer than five compressive-strength tests for a given concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143; one test at point of placement for each composite sample. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample of air-entrained concrete.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 90 deg F and above.
5. Density: ASTM C138/C138M, fresh density of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39; test one laboratory-cured specimen at 7 days two at 28 days, and hold one specimen in reserve for later testing if necessary.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, Structural Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project name, date of concrete placement and testing, location of concrete batch in Work, mix identification including design compressive strength at 28 days, slump, compressive breaking strength, and type of break for both 7-and 28-day tests. Air content and concrete temperature results shall also be provided when applicable.

E. Special inspector shall monitor the installation of post-installed concrete anchors and reinforcing. Before installation of each type anchor or reinforcing begins, the inspector shall verify that the contractor’s proposed installation procedure conforms with the manufacturer’s printed installation instructions (MPII). The inspector shall monitor the initial installation of each type of anchor or reinforcing to verify conformance with the (MPII) and shall monitor periodically thereafter.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive devices will not be used as sole basis for approval or rejection of concrete.

G. Additional Tests: Special inspector shall make additional tests of concrete at Contractor's expense when test results indicate that slump, air entrainment, compressive strength, or other requirements have not been met, as directed by Architect. Special inspector may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect. Contractor shall fill core-drilled holes with non-shrink grout unless directed otherwise by Architect.

END OF SECTION 033000

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete Block.

B. Concrete Brick.

C. Clay Facing Brick.

D. Mortar and Grout.

E. Reinforcement and Anchorage.

F. Lintels.

G. Accessories.

1.02RELATED REQUIREMENTS

A. Section 04 2300 - Reinforced Unit Masonry: Additional requirements for reinforced loadbearing masonry.

B. Section 05 5000 - Metal Fabrications: Loose steel lintels.

C. Section 06 1000 - Rough Carpentry: Nailing strips built into masonry.

D. Section 07 2119 – Closed Cell Foamed-in-Place Insulating System: Weather barrier for masonry surfaces and membrane flashings.

E. Section 07 1900 - Water Repellents: Masonry waterproofing.

F. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.

G. Section 07 9005 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.03 PRICE AND PAYMENT PROCEDURES (Not applicable to this project)

A. This allowance includes purchase, sales tax and delivery of face brick. Installation is not included in the allowance but is specified in this section and is part of the Contract Sum/Price.

1.04 REFERENCE STANDARDS

A. ACI 216.1/TMS 0216.1 - Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

B. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures; American Concrete Institute International; 2008.

C. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures; American Concrete Institute International; 2008.

D. ASTM A 82/A 82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

E. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

F. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2009b.

G. ASTM C 33 - Standard Specification for Concrete Aggregates, 2007.

H. ASTM C 55 - Standard Specification for Concrete Brick; 2009.

I. ASTM C 67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2009.

J. ASTM C 90 - Standard Specification for Load bearing Concrete Masonry Units; 2009.

K. ASTM C 91 - Standard Specification for Masonry Cement; 2005.

L. ASTM C 128 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.

M. ASTM C 140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2010.

N. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar; 2004.

O. ASTM C 150 - Standard Specification for Portland Cement; 2007.

P. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006.

Q. ASTM C 216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2007a.

R. ASTM C 270 - Standard Specification for Mortar for Unit Masonry; 2008a.

S. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.

T. ASTM C 331 - Standard Specification for Lightweight Aggregates for Concrete Masonry Units; 2005.

U. ASTM C 404 - Standard Specification for Aggregates for Masonry Grout; 2007.

V. ASTM C 476 - Standard Specification for Grout for Masonry; 2009.

W. ASTM C 780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2009.

X. ASTM C 1634 - Standard Specification for Concrete Facing Brick; 2009.

Y. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2006.

Z. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition. 1.05 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Samples: Submit four full-size samples of facing brick and each type of concrete block units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
   1. The producer of the concrete masonry units shall furnish a letter of certification stating that all aggregates used conform to the specifications as noted herein and ASTM standards. Certificate shall indicate the type of aggregates that are used in the mix design. a. Certificate shall include ACI 216 fire resistance certification.
      b. Certificate shall include UL fire resistance certification.
      c. Certificate shall include ASTM C90 certification.
      d. Certificate shall certify that lightweight aggregate complies with ASTM C331 with 6% to 10% absorption when tested in accordance with ASTM C128.
      e. Certificate by independent testing facility that the lightweight aggregates are 100% recycled material.
      f. Certificate stating minimum STC rating of each type block and that block meet specified sound transmission requirements.
      g. Test Report showing stain index per ASTM C641 =0.

h. Test Report showing organic impurities per ASTM C40 < 1.

2. Brick test reports shall show:
   a. Compressive strength.
   b. 24 - hr. cold water absorption.
   c. 5 - hr. boil absorption.
   d. Saturation coefficient.
   e. Initial rate of absorption (suction).
3. Provide certificates for each type of fire rated masonry.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

F. Contractor shall provide the Owner with one cube (1,000 brick) of utility brick for each color used on the project upon project completion. Deliver to storage location as directed by Owner.

1.06 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.

B. Fire Rated Assemblies: Conform to applicable code and UL requirements for fire rated masonry construction as noted on drawings.

C. All membrane wall and flashings around building openings are to be installed by an established and qualified waterproofing contractor.

1.07 EXTERIOR WALL ASSEMBLY MOCK-UP (Facing the sun)

A. Construct a masonry wall as a mock-up panel sized 6 feet long by 5 feet high; include mortar and accessories, structural backup, flashings, and each type of unit as directed by Architect, including cast stone masonry units, Aluminum Window System (with glazing and sillpans) and all other components as detailed and specified in the mock-up. Coordinate with all building envelope trades as conditions at ALL adjacent construction are to be included.
   1. Mock-up panel shall show the complete and full range of exposed texture and color to be expected in the work and shall indicate materials, bond, joint tooling and workmanship to be expected in the final work.

B. Erect mock up panel in ‘cut away’ stages to allow for proper review.

C. Locate where directed.

D. Mock-up may not remain as part of the Work.
   1. Retain panel during construction as standard for judging completed masonry work. Do not alter, move or destroy panel until work is completed and accepted.

1.08 COLOR SELECTION PANELS (Facing the sun)

A. A minimum of (1) 3’ x 4’ panels will be required to be constructed for the purposes of selecting exterior masonry and mortar colors. (Match existing exterior colors)
B. Following color selections by the architect; the exterior wall assembly mock up panel is to be constructed in the selected colors. (Contractor to provide samples matching existing exterior colors)

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Handle and store masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation. Stored units shall remain covered until installed.

C. Units shall be handled to avoid breakage and chipping. Any chips outside of the requirements of specified ASTM standards shall not be placed in the finished wall. Units placed in the wall will be the responsibility of the installer and damaged units shall be replaced as directed by the Architect.

D. Protect reinforcement from elements

1.10 JOB CONDITIONS:

A. Protection of Work:
1. During erection, cover top of wall with strong waterproof membrane at end of each day or shutdown. Cover partially completed walls when work is not in progress. Extend cover minimum of 24 in. (610 mm) down both sides. Hold cover securely in place.
2. Protect door jambs and corners from damage during construction.

B. Load Application:
1. Do not apply uniform floor or roof loading for at least 12 hours after building masonry columns or walls.
2. Do not apply concentrated loads for at least 3 days after building masonry columns or walls.

C. Staining:
1. Prevent grout or mortar from staining the face of masonry to be left exposed or painted. Remove excess grout or mortar immediately that is in contact with face of masonry. Protect all sills, ledges and projections from droppings of mortar.
2. Protect the base of all walls from rain, mud and mortar splashes with straw or sand.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. Adams Products Company; www.adamsproducts.com
2. Johnson Concrete Products; www.johnsoncmu.com
3. Southeastern Concrete Products; www.seconcreteproducts.net
4. Substitutions: See Section 01 60 00 Product Requirements.

2.02 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
1. LEED requirements:
a. Regional Materials - Concrete Masonry Units shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
b. Concrete block walls consisting of 8" x 8" x 16" units shall meet STC rating of 45 or more.
c. Recycled Content of Lightweight Aggregate: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 50 percent.
d. Lightweight aggregates shall be certified by an independent testing facility that lightweight aggregates meet all qualifications of 100% recycled material.
2. Size: Standard units shall be modular with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.
a. Units shall be sound, free from cracks, chipped edges and other defects and have a uniform fine texture.
b. Units shall be delivered to the project site in an air-dried condition.
3. Aggregates: All units shall be free of organic impurities that will cause rusting, staining or pop outs, and shall contain no combustible matter.

a. Lightweight Aggregate: ASTM C331 and C330; Lightweight aggregate shall be 100% expanded shale Stalite material produced by the rotary kiln process with 6% to 10% absorption when tested in accordance with ASTM C128 and shall be graded to assure constant texture.
b. Normal weight Aggregate: ASTM C33
c. THE USE OF COAL CINDER AGGREGATE/BOTTOM ASH OR SIMILAR WASTE PRODUCTS OR OTHER IMPURITIES WILL NOT BE ALLOWED.

4. All 8-inch deep or larger units shall meet ACI 216 requirements for 2 hour or greater fire resistance.
5. Special Shapes: Provide non-standard blocks configured for square corners, lintels, headers, control joint edges, bond beams, and other detailed conditions. a. Provide radius corners.
6. Load-Bearing Units: ASTM C 90, lightweight. (25 lb block minimum with STC rating 45 minimum for 8" and 12" units) a. Hollow block.
   b. Exposed faces: Manufacturer's standard color and texture where indicated.
   c. 2 &3-hour fire resistance rating certified by UL.
7. Fire Resistance: Provide units that comply with fire rating indicated as shown. Firerated units shall be manufactured to comply with the minimum equivalent thickness required for the fire resistance indicated and the type of aggregate used. a. Provide 2 &3hour fire resistance rating certified by UL.

B. Concrete Brick:
   1. For architectural and paver use, ASTM C 1634 (or ASTM C 55-03 Grade N), non-cored (solid), medium weight.
   2. For other uses, ASTM C 55, medium weight.
   3. Size: As indicated on drawings.

2.03 CLAY BRICK UNITS

A. LEED requirements:
   1. Regional Materials: Brick shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project Site.

B. Facing Brick: ASTM C 216, Type FBS, Grade SW.
   1. Color and texture:
      a. Brick Color #1 (Field): Utility Brick, 4 x 4 x 12 (Nominal)
      b. Brick Color #2 (Accent): Utility Brick, 4 x 4 x 12 (Nominal)
      c. See Allowances for brick allowance per 1000 brick
   2. Nominal size: Utility - 3-5/8" high x 11-5/8" wide x 3-1/2" deep;
      Closure brick – 3-5/8” high x 7-5/8” wide x 3-1/2” deep
   3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
   4. Compressive strength: 8,000 psi, measured in accordance with ASTM C 67.
   5. Provide brick similar in texture and physical properties to those available for inspection at the Architect/Engineer’s office.
   6. Do not exceed variations in color and texture of samples accepted by the Architect/Engineer.

C. Facing Brick shall have the full range of brick colors mixed throughout in a uniform percentage of colors. All brick to be delivered to the site shall match throughout the project. Provide solid units, closure units, corner units and special shapes as required for the work. See drawings for special shapes required in the work.

2.04 MORTAR AND GROUT MATERIALS

A. LEED Requirements:

1. Regional Materials - Aggregate for mortar and grout, cement, and lime shall be manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Masonry Cement: ASTM C 91, Type S load bearing and below ground masonry. Type N for all other masonry including masonry veneer and cast stone masonry.
   1. Mortar color shall be standard gray for CMU (unless otherwise indicated), and shall match for the duration of the project.

C. Portland Cement: ASTM C 150, Type I; color as required to produce approved color sample.
   1. Hydrated Lime: ASTM C 207, Type S.
   2. Mortar Aggregate: ASTM C 144.
   3. Grout Aggregate: ASTM C 404.
      a. Sand: White, washed masonry sand. UNWASHED SAND WILL NOT BE ALLOWED AND WILL BE CAUSE FOR REJECTION OF WORK. D. Water: Clean and potable.

E. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

2.05 REINFORCEMENT AND ANCHORAGE

A. Manufacturers of Joint Reinforcement and Anchors:
   1. Dur-O-Wal: www.dur-o-wal.com.
   2. Hohmann & Barnard, Inc: www.h-b.com.
   3. Masonry Reinforcing Corporation of America: www.wirebond.com.
   4. Substitutions: See Section 01 25 00 - Substitution Procedures.

B. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420) deformed billet bars; galvanized.

C. Single Wythe Joint Reinforcement: Ladder type; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/A 153M, Class B; 0.1483-inch side rods with 0.1483-inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

D. Multiple Wythe Joint Reinforcement: Ladder type; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/153M, Class B; 0.1483-inch side rods with 0.1483inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

E. Adjustable Multiple Wythe Joint Reinforcement: Ladder type with adjustable ties or tabs spaced at 16 in on center ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/153M, Class B; 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire; width of components as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from each masonry face.
   1. Vertical adjustment: Not less than 3-1/2 inches.
   2. Seismic Feature: Provide lip, hook, or clip on extended leg of wall ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483-inch diameter.
   3. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.

F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face.
   1. Steel frame: Crimped wire anchors for welding to frame, 0.25-inch thick, with trapezoidal wire ties 0.1875-inch-thick, hot dip galvanized to ASTM A 153/A 153M, Class B. 2.06 FLASHINGS

A. Metal Flashing Materials: Shall be as specified in Section 07 6200.

B. Thru-wall Membrane Flashing Materials: Textroflash by Hohmann & Barnard; 40 mil thick thruwall flashing/surface-mounted composite membrane flashing with an adhesive backing factorylaminated to a rugged, polyethylene sheeting, yielding a flexible membrane suitable for use on masonry, concrete, steel, gypsum and wood. Apply Primer-SA Hohmann & Barnard's waterbased primer for self-adhering flashing on all surfaces to receive this membrane flashing. Apply in strict accordance per the membrane manufacturer's written instructions. UV resistance is for up to 120 days. The masonry contractor is to coordinate with the waterproofing contractor well in advance for the installation ALL membrane flashing.

2.07 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self-expanding; 3inch-wide x by maximum lengths available.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
1. Airspace Maintenance and Drainage Material: Polymer mesh panels for fitting between masonry ties to loosely fill masonry cavity. Installed continuous at all sills, heads, and all other horizontal conditions. Drainage Mat shall be 16" in height. a. Manufacturers:
1) CavClear/Archovations, Inc; CavClear Masonry Mat:

www.cavclear.com. 2) Substitutions: See Section 01 6000 - Product Requirements. D. Building Paper: ASTM D 226, Type I ("No.15") asphalt felt.

E. Weeps: Molded PVC grilles, insect resistant.
1. Manufacturers:
a. Wire-Bond; Product - #3601 Cell Vent for weep holes. Color as selected by architect, jumbo size.
b. Williams Products, Inc.; Product - Williams-Goodco brick vent for cavity walls
c. Substitutions: See Section 01 6000 - Product Requirements.

F. Cavity Vents: Molded PVC grilles, insect resistant.
1. Manufacturers:
a. Wire-Bond; Product - #3601 Cell Vent for weep holes. Color as selected by architect, jumbo size.
b. Williams Products, Inc.; Product - Williams-Goodco brick vent for cavity walls:
c. Substitutions: See Section 01 6000 - Product Requirements.

G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials. 2.08

LINTELS

A. See Structural Drawings.

2.09 MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C 270, using the Proportion Specification.
1. Masonry below grade and in contact with earth: Type S.
2. Exterior, loadbearing masonry: Type S.
3. Exterior, non-loadbearing masonry: Type N.
4. Interior, loadbearing masonry: Type N.
5. Interior, non-loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio. Submit samples to Architect for selection.

1. Brick #1 Mortar Color – Color as selected by Architect.

Note: Mortar Color for Brick #1 shall be Argos "Khaki" for bidding purposes. Final mortar colors will be determined upon completion of the exterior wall assembly mock-up.

3. Cast Stone Mortar Color – Color as selected by Architect to match cast stone components.

Mortar shall be selected from the following mortar manufacturers:

1. Holcim (US) Inc.
2. LaFarge North America Inc.

C. Grout: ASTM C 476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Cleaning Reinforcement: Before being placed, remove loose rust, ice and other coatings from reinforcement.

D. Wet brick with absorption rates in excess of 30 g./30 sq. in./min. (30 g./194 cm2/min.) determined by ASTM C 67, so that rate of absorption when laid does not exceed this amount.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of ACI 530.1/ASCE 6/TMS 602 or applicable building code, whichever is more stringent.

B. Remove all masonry deemed frozen or damaged.

C. Do not use wet or frozen CMW units.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness (3/8").

C. Concrete Masonry Units:
1. Bond: Running Bond
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: "Concave" Joint.

D. Brick Units:
   1. Bond: 1/3 Running Bond
   2. Coursing: Two units and two mortar joints to equal 8 inches.
   3. Mortar Joints: “Concave”.

3.05 PLACING AND BONDING

A. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.
   1. Face Brick: Mix brick from several pallets at a time during installation.

B. Layup walls plumb and true and with courses level, accurately spaced and coordinated with other work.

C. Lay in fire rated walls with masonry units that comply with fire rating shown.

D. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

E. Lay hollow masonry units with face shell bedding on head and bed joints.

F. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

G. Remove excess mortar and mortar smears as work progresses.

H. Interlock intersections and external corners.

I. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

J. Stop off horizontal run of masonry by racking back 1/2 length of unit in each course. Toothing is not permitted except upon written acceptance of the Architect/Engineer.

K. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

L. Cut mortar joints flush where wall tile is scheduled and other concealed locations.

M. Provide radius corner at all outside corners in the interior of the building, except first course above finish floor and top course at ceiling line shall have square corners for joints at wall base and ceiling suspension system.

N. Isolate masonry partitions from vertical structural framing members with a control joint.

O. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 MORTAR BEDDING AND JOINTING:

A. Lay brick and other solid masonry units with complete filled bed and head joint; and shove into place. Do not slush head joints.

B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells; also, bed webs in mortar in starting course on footing and foundation walls and in all courses of piers, columns and pilasters and where adjacent to cells or cavities to be reinforced or to be filled with concrete or grout.

C. Remove masonry units disturbed after laying; clean and relay in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

D. Joints: Maintain joint widths shown, except for minor variations required to maintain bond alignment. Rake out mortar where applicable in preparation for application of caulking or sealants.

E. Tool all masonry joints on exposed faces. ALSO, TOOL ALL JOINTS ON OUTSIDE FACE OF THE INTERIOR WYTHE OF MASONRY WITHIN CAVITY TO RECEIVE FLUID-APPLIED AIR BARRIER MEMBRANE. JOINTS SHALL BE COMPLETELY FILLED AND TOOLED WITHOUT VOIDS.

F. Thoroughly clean all excess mortar droppings off brick ties and CMU faces prior to application of the fluid-applied air barrier membrane.

G. All surfaces will be inspected by the waterproofing contractor for acceptance prior to application of the fluid-applied air barrier membrane. Any areas or conditions of non-compliance must be corrected at the mason's expense.

3.07 WEEPS/CAVITY VENTS

A. Install weep in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls. Weeps must be installed directly on top of flashing to avoid damming.

B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels, and near top of walls.

3.08 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar control panels continuously throughout exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions. Verify that airspace width is no more than 3/8 inch greater than panel thickness. Install horizontally between joint reinforcement. Stagger end joints in adjacent rows. Fit to perimeter construction and penetrations without voids.

3.09 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Horizontal Reinforcement: Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 3/4" on exterior side of walls and 1/2" at other locations. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

3.10 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

3.11 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.12 REINFORCEMENT AND ANCHORAGES - CAVITY WALL MASONRY

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of openings.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Space anchors at maximum of 24 inches horizontally and 24 inches vertically.

F. Keep cavity clean of mortar droppings during construction. Strike joints facing cavity flush.

3.13 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted. Coordinate with waterproofing contractor to ensure proper installation locations of membrane flashings on the substrate. The waterproofing contractor will install all membrane flashings on the substrates and the masonry contractor will continue the installation within the masonry veneer.
   1. Extend flashings full width at such interruptions and at least 8 inches into adjacent masonry or turn up at least 4 inches to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.

C. Extend laminated flashings to within 1/4 inch of exterior face of masonry.

D. Lap end joints of flashings at least 4 inches and seal watertight with mastic or elastic sealant.

E. Provide surface primer at all surfaces in strict accordance with membrane flashing manufacturer’s written instructions.

3.14 LINTELS

A. Install loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
   1. Do not splice reinforcing bars.
   2. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
   3. Place and consolidate grout fill without displacing reinforcing.
   4. Allow masonry lintels to attain specified strength before removing temporary supports. C.

Maintain minimum 8-inch bearing on each side of opening.

3.15 GROUTED COMPONENTS

A. Grout all CMU cells solid.

B. Place reinforcement in bond beams and columns as shown on structural drawings.

C. Lap splices minimum 24 bar diameters.

D. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

E. Place and consolidate grout fill without displacing reinforcing.

F. Grout all block cores at walls where noted on drawings.

3.16 CONTROL AND EXPANSION JOINTS

A. Provide vertical expansion, control and isolation joints in masonry where shown. If not shown provide at a distance of 3 times the wall height not to exceed 35'-0" and 4'-0" off corners. In any case, consult architect before placement. Built-in related masonry accessory items as the masonry work progresses. Rake out mortar in preparation for application of sealant backing rod and sealant. Insert a build-in Styrofoam insulation board in vertical expansion joints where shown on plans. (The waterproofing contractor will install a 12" vertical strip of continuous 40 mil flash shall be placed on the cavity side of the interior wall and turned out blow floor level). CMU control joints, if indicated, are to be used as a guide only. Contractor is to coordinate with all openings and position as required.

B. Do not continue horizontal joint reinforcement through control and expansion joints.

C. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

D. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

E. Size control joint in accordance with Section 07 90 05 for sealant performance.

F. Form expansion joint as detailed.

3.17 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, glazed frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.

1. Fill space between hollow metal frames and masonry solidly with mortar.

2. Leave joints around outside perimeters of aluminum storefront exterior doors, window frames and other wall openings to receive joint sealant. B.

Install builtin items plumb, level, and true to line.

C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.18 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and ducts. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.19 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4500.

B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C 67 requirements, sampling 5 randomly chosen units for each 50,000 installed.

C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C 140 for conformance to requirements of this specification.

D. Mortar Tests: Test each type of mortar in accordance with ASTM C 780, testing with same frequency as masonry samples.

E. Special inspections
1. Verify all reinforcement placement, including required laps, before grouting.
2. Verify that all grout placement complies with code and construction document provisions.
3. No grouting of masonry to be performed until testing laboratory has inspected re-bar placement.
4. Grout shall be sampled and tested for compressive strength per ASTM C1019. 3.20 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.
1. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Remove efflorescence prior to final acceptance of the project.
2. Clean architectural polished colored CMU masonry with clean, soft, damp rags. Wipe off at once all mortar smears and spatters. Do not allow hardening. Final clean down to be in strict accordance with block manufacturer's recommendations, including thorough rinsing. Damp-dry with clean, soft rags. Do not use acid, steel wood, or other abrasives.
3. Clean exposed brick masonry surfaces as recommended by BIA Technical Notes "Cleaning Brick Masonry". Clean exposed masonry from top down. Chemical cleaners shall be mixed and applied in accordance with the manufacturer's recommended specifications. Use of muriatic acid is prohibited.
4. BRICK: PRIOR TO APPLICATION OF CHEMICAL CLEANERS, THE EXPOSED FACE OF THE BRICK SHALL BE THOROUGHLY SATURATED WITH WATER. APPLY CHEMICAL CLEANERS IN CAREFUL ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. AFTER CLEANING OPERATIONS ARE COMPLETED, THOROUGHLY FLUSH THE FACE OF THE BRICK WITH WATER UNTIL ALL CLEANING RESIDUE HAS BEEN REMOVED.
5. PROTECT ALL ADJACENT NON-MASONRY SURFACES FROM COMING INTO CONTACT WITH CHEMICAL CLEANERS. ANY DAMAGE TO ADJACENT SURFACES SHALL BE REPAIRED AT CONTRACTOR'S EXPENSE. D. Use non-metallic tools in cleaning operations.

3.21 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities. END OF SECTION

1.0 GENERAL:

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including general and supplementary conditions and Division 1 specification sections, apply to work of this section.

ACI 530.1, Specifications for Masonry Structures

1.2 DESCRIPTION OF WORK: Extent of each type of reinforced unit masonry work is indicated on drawings and in schedules.

1.3 SUBMITTALS:

A. General: Submit the following in accordance with conditions of the Contract and Division 1 Specification Sections.

B. Product Data: For each type of manufactured material and product, including concrete block, reinforcement, reinforcement accessories, joint systems, and others if requested.

C. Shop drawings: Submit 4 copies of shop drawings for fabrication, bending and placement of reinforcement bars. Comply with ACI 315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures”. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work. The shop drawings must include detailed elevations of reinforcing in order for the engineer to properly review. D. Steel Reinforcement: Provide Mill certificates for all steel reinforcement.

E. Fire Resistance Rating Certification: Provide written certification that the concrete block provided for this project meets the requirements of the International Building Code, latest edition, for the fire resistance rated block required for the fire resistance rated assemblies for this project.

2.0 PRODUCTS:

2.1 MATERIALS:

A. General: Refer to Section “Unit Masonry” for masonry materials and accessories not included in this section.

B. Reinforcement Bars: Provide deformed bars of following grades complying with ASTM A615, except as otherwise indicated.

1. Provide Grade 60 for all reinforcing bars.
2. Shop-fabricate reinforcement bars which are shown to be bent or hooked.

C. All CMU used for fire rated walls must meet the IBC requirements for rating of the block per 20178 IBC table 722.3.2 or be UL listed and approved for the required hourly rating of the wall as indicated on the plans.

3.0 EXECUTION:

3.1 PLACING REINFORCEMENT:

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1" (whichever is greater).

C. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Architect. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
1.Lap all bars as follows:

Bar Size	Lap Length
#4	2'-0"
#5	2'-6"
#6	3'-0"

D. Vertical reinforcement shall be secured against displacement prior to grouting at intervals not exceeding 8 feet.

E. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.

3.2 INSTALLATION GENERAL:

A. Refer to Section "Unit Masonry" for general installation requirements of unit masonry.
B. Refer to masonry notes in structural drawings for additional installation requirements.

3.3 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY: A.

General:

1. Do not wet concrete masonry units (CMU).
2. Lay CMU units with full-face shell mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 3/8" joints.

Where solid CMU units are shown, lay full mortar bead and bed joints.

B. Walls:

1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use specialshaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.

2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.

3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement and other reinforcing bars. Place small mesh, expanded metal lath, or wire screening in mortar joints under bond beam courses over cores or cells on nonreinforced vertical cells, or provide units with solid bottoms. C. Columns, Piers and Pilasters:

1. Use CMU units of the size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or not shown, alternate head joints in vertical alignment.

D. Grouting:

1. Grout shall be provided by the ready-mix concrete producer. See Section 033300 for submittal requirements. Grout shall be course grout, having a design slump of at least 4".
2. Grout shall have a minimum 28-day compressive strength of 2500 psi. Slump shall be 8 to 11 inches. Vibrate grout to assure cells are filled solid.
3. Compressive strength of grout shall be determined by ASTM C 1019-99. One set of 4 compressive strength specimens shall be fabricated and tested for each days placement of grout, or for each 30 cubic yards of grout, whichever is less. E. Low-Lift Grouting:

1. Provide minimum clear dimension of 2" and clear area of 8 sq. in. in vertical cores to be grouted.
2. Place vertical reinforcement prior to laying of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters not 8 ft.
3. Lay CMU to maximum pour height. Do not exceed 6' height, or to include the next bond beam, whichever is less.
4. Pour grout using chute or container with spout. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 1 1/2" below top course of pour.
5. Bond Beams: Stop grout in vertical cells 1 1/2" below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. **Place grout in bond course before placing CMU**.

F. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry t ensure bond. After final cleaning and inspection, close clean out holes and brace closures to resist grout pressures.

1. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.

G. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Architect.

H. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 4'. Allow not less than 30 minutes, or more than one hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.

1. Place grout in lintels or beams over openings in one continuos pour.

I. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 1" of vertically reinforced cavities, during construction of masonry.

J. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1 1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more ours are required.

END OF SECTION

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes structural steel and architecturally exposed structural steel.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts in concrete.
2. Division 4 Section "Unit Masonry" for installing anchor bolts in unit masonry.
3. Division 5 Section "Steel Joist Framing" for coordinating joist connections to structural steel.

1.3 SUBMITTALS

A. General: Submit the following in accordance with conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings detailing fabrication of structural steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted snug-tightened, pretensioned, or slip-critical connections. D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Mill test reports certifying that structural steel complies with requirements, including chemical and physical properties.

F. Manufacturer’s certificates of compliance certifying that their products, including the following, comply with requirements.

1. Weld filler materials for both shop and field welding.
2. Twist-off type tension control bolts.
3. Nonshrink grout.

G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

A.

1.4 QUALITY ASSURANCE

Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar to this Project with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to this Project and with a record of successful in-service performance. Fabricator must meet one of the following requirements:

1. A qualified fabricator who is currently certified by the AISC Quality Certification Program for Structural Steel Fabricators and is designated as AISC Certified Fabricator, Standard for Steel Building Structures.

2. Fabricator must maintain detailed written fabrication, material control, and quality control procedures that provide a basis for inspection control of the workmanship and the fabricator’s ability to conform to approved construction documents and referenced standards.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings."
2. AISC's "Seismic Provisions for Structural Steel Buildings."
3. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
4. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

D. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusted before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures.

1.6 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting templates and instructions as required for installation.

1.7 MATERIALS

A.

Structural Steel Shapes, Plates, and Bars: As follows:

1. Wide Flange Shapes and Tees: ASTM A 992.
2. Other Shapes, Plates and Bars: ASTM A 36.
3. Plate Where Indicated 50 ksi: ASTM A572, Grade 50.

B. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B or C.

C. Steel Pipe: ASTM A 53, Type E or S, Grade B.

D. Headed Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, coldfinished carbon steel, AWS D1.1, Type B with ceramic ferrules. Stud heights shown on the drawings are net lengths after welding. Studs used for composite beams with steel deck shall extend not less than 1½ inches above the top of the steel deck. E. Anchor Rods, Nuts, and Washers: As follows:

1. Anchor Rods: ASTM F 1554, Grade 36.
2. Nuts: ASTM A 563, heavy hex carbon steel nuts.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Plate Washers: ASTM A 36, carbon steel plate washers in accordance with Table 14-2 of AISC's “Steel Construction Manual", Thirteenth Edition, 1/4 inch plate thickness for anchor rods up to 1 inch diameter, 3/8 inch plate thickness for anchor rods larger than 1 inch diameter.

F. High-Strength Bolts, Nuts, and Washers: As follows:

1. All bolts shall be of domestic manufacture.
2. Bolts: ASTM A 325, Type 1, heavy hex steel structural bolts.
3. Nuts: ASTM A 563, heavy hex carbon steel nuts.
4. Washers: ASTM F 436, flat, circular carbon steel washers.
5. Twist-Off Type Tension Control Bolts: ASTM F 1852, Type 325.
6. Finish: Plain, uncoated. G. Threaded Rods: ASTM A 36.

H. Forged Steel Hardware:

1. Clevises, Turnbuckles: AISI C 1035.
2. Clevis Pins: AISI C 1018 or AISI C 1035.
3. Eye Bolts, Eye Nuts: ASTM A 489.
4. Sleeve Nuts: AISI C 1018, Grade 2.
5. Finish: Plain, Uncoated.

I. Welding Electrodes: Comply with AWS requirements.
1. Electrodes shall be E70XX.
2. All electrodes for welding ASTM A 992 steel shall be low hydrogen electrodes with a maximum of 16 ml of diffusible hydrogen per 100 g of deposited weld metal.
3. Electrodes for all welds in moment connections, including shear tabs and stiffener plates, shall have a minimum Charpy V-Notch toughness of 20 foot-pounds at –20 degrees F, and 40 foot-pounds at 70 degrees F.

1.8 PRIMER AND PAINT

See the Architectural drawings and Division 9 Sections for areas which are scheduled to receive a paint topcoat and for topcoat paint systems.

A.

B. Primer for Steel not to Receive Topcoat: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79.

C. Primer for Steel to Receive Topcoat: Comply with Division 09 painting Sections, or if not specified in Division 09 painting Sections, use the following:

1. Interior Steel: SSPC Paint 25, Type II, zinc oxide, alkyd, linseed oil primer.
2. Exterior Steel: SSPC Paint 25 BCS, Type II, zinc oxide, alkyd, linseed oil primer.

D. Primer for Steel which Receives Intumescent Paint: Use a primer which is approved by the intumescent paint supplier.

E. Primer color may be selected by contractor, however only one single color of primer may be incorporated in the Work.

F. Galvanizing Repair Paint: Conform to ASTM A 780 or Military Specification MIL-P-21035A. Acceptable products include, but are not limited to:

1. Galvacon GC-243 Cold Galvanizing Compound, Lanco.
2. Zinga, ZingaMetall.
3. Rust-Oleum Stops Rust Cold Galvanizing Spray, Rust-Oleum.
4. ZRC Cold Galvanizing Compound, ZRC Worldwide.

1.9 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Five Star Grout; U.S. Grout Corp.
2. Masterflow 713; Master Builders.
3. Sonneborn Sonogrout 10K; ChemRex, Inc.
4. NS Grout, Euclid Chemical Company.
5. SC Multipurpose Grout, SpecChem, LLC.
6. Enduro 50; Conspec.

1.10 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural steel members where indicated.
2. Mark and match-mark materials for field assembly.
3. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
4. Complete structural steel assemblies, including welding of units, before starting shoppriming operations.

5. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
6. Welds which will be exposed to view in the completed structure shall have a neat and uniform appearance. Such welds shall be continuous, not intermittent. Plates which are exposed to view on bottoms of beams shall be straight and aligned at joints, and shall be butt welded together at joints with all welds ground smooth.

B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale, seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel. C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

D. Headed Shear Connectors: Prepare steel surfaces as recommended by manufacturer of headed shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.

E. Joists: Coordinate requirements for support of open-web steel joists with joist supplier.

1. Where joists are supported by steel columns, or on the sides of steel beams, or are bolted to steel framing, or where stabilizer plates are required for joist bottom chords, coordinate the steel details with the joist supplier. Provide required supports, holes, and stabilizer plates as required by joist supplier.
2. Where joists are supported by sloped diagonal steel beams, coordinate the steel details with the joist supplier. Provide required plate seats on beams as required by joist supplier.

F. At roof edges where joist extensions occur to support a continuous edge angle or bent plate, extend the top portion of beams which are parallel with joists same as the adjacent joist extensions unless indicated otherwise.

G. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning.

H. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

I. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPCSP 1, "Solvent Cleaning."

J. Tube Members: Provide ¾” minimum cap plates on tube columns which support beams unless otherwise indicated. Provide ¼” closure plates on ends of all other tube members unless another connection is indicated. Where the tube end is exposed to view, grind closure plate smooth and flush with tube face all around, including at curved corners of tube.

1. On tube members which will be exposed to view in the completed structure, the seam on the tube shall be oriented away from view. For columns, locate seam facing towards a wall, and for beams, locate seam on upper surface of tube unless indicated otherwise.

1.11 SHOP CONNECTIONS

A. Shop install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

1. Bolts: ASTM A325 high-strength bolts, unless otherwise indicated.
2. Connection Type: Snug tightened, unless indicated as pretensioned or slip-critical.

B. Welded Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

1.12 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed-on fireproofing.
5. Top flanges of beams to receive field welded headed shear connectors or field welded rebar.
6. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces as follows:

1. Steel not to Receive Topcoat: SSPC-SP 1 "Solvent Cleaning", followed by SSPC-SP 2 "Hand Tool Cleaning."
2. Interior Steel to Receive Topcoat: Comply with Division 09 painting Sections, or if not specified in Division 09 painting Sections, use SSPC-SP 1 "Solvent Cleaning", followed by SSPC-SP 2 "Hand Tool Cleaning."
3. Exterior Steel to Receive Topcoat: SSPC-SP 6 "Commercial Blast Cleaning."
4. Faying surfaces and surfaces adjacent to bolt heads and nuts shall be free of dirt and foreign material. Faying surfaces at slip-critical connections shall also be free of scale, except tight mill scale, and free of coatings, including inadvertent overspray.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness complying with Division 09 painting Sections, but not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1.13 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A123.

B. Galvanize shelf angles, steel lintels in exterior walls, and other items as indicated.

C. Where tubes or pipes in exterior elements exposed to the weather have vent holes for galvanizing, the vent holes shall be closed using plug welds and then ground smooth and flush. Holes shall be closed after galvanizing and then painted with galvanizing repair paint.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Before erection proceeds, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

2.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Where temporary shoring is required for composite deck construction, do not remove shoring until cast-in-place concrete has attained its 70 percent of its design compressive strength.

2.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base Plates and Bearing Plates: Clean concrete and masonry bearing surfaces of bondreducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base plates and bearing plates for structural members on wedges, shims, or leveling nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to grouting.
3. Grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. E.

Splice members only where indicated.

F. Remove welded identification tags, erection bolts and clips on all steel which will be exposed to view in the completed structure; fill holes with plug welds; and grind smooth at exposed surfaces. Remove paper tags and stickers which will interfere with or show through painting. G. Finish sections thermally cut during erection equal to a sheared appearance.

H. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

I. Brick shelf angles shall be welded to the supporting structure only after concrete slabs are in place.

2.4 FIELD CONNECTIONS

A. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

1. Bolts: ASTM A325 high-strength bolts, unless otherwise indicated.
2. Connection Type: Snug tightened, unless indicated as pretensioned or slip-critical.
3. Tensioned bolts: For bolted connections indicated as pretensioned or slip-critical, use twist-off type tension control bolts.

B. Welded Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
3. Welds which will be exposed to view in the completed structure shall have a neat and uniform appearance. Such welds shall be continuous, not intermittent. Plates which are exposed to view on bottoms of beams shall be straight and aligned at joints, and shall be butt welded together at joints with all welds ground smooth.
4. Shielded Metal Arc Welding (SMAW) or Flux Cored Arc Welding (FCAW) are acceptable welding processes for shop or field welding. FCAW-S (self-shielded) shall not be mixed with any other welding process in the same weld in moment connections.

5. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

C. Headed Shear Connectors: Weld headed shear connectors through deck to supporting members using automatic end welding according to AWS D1.1 and manufacturer's written instructions.

1. Do not use shielded metal arc welding (“stick” welding) to weld headed shear connectors unless limited access prevents using automated equipment. Where limited access prevents using automated equipment, studs may be welded by hand using a 5/16” fillet weld all around.
2. At start of each welding operation, operator shall weld two headed shear connectors and visually verify that they exhibit full 360 degree flash. Studs shall then be bent to an angle of approximately 30 degrees from vertical. Satisfactory visual and bend tests shall be obtained on two consecutive headed shear connectors before production welding commences.
3. Remove and discard ferrules after welding headed shear connectors.

2.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform field inspections and tests and to prepare test reports.

1. Special inspector will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Contractor shall ensure that no items which are to be tested or inspected are covered up by earth, concrete, deck or other materials before testing and inspection are complete.

C. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

D. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

E. Periodically inspect steel frame joint details for compliance with approved construction documents.

F. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Verify that washers are installed as required by RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Snug-Tightened Connections: Visually verify that all plies of the connected elements have been brought into firm contact.
3. Slip-Critical Connections and Pretensioned connections indicated to have faying surfaces prepared as required for slip-critical connections: Prior to assembly, visually verify that faying surfaces of joints meet the requirements of RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

G. Provide continuous visual inspection of all multi-pass fillet welds, all single-pass fillet welds greater than 5/16", and all complete and partial penetration groove welds. Provide periodic visual inspection of single-pass fillet welds less than or equal to 5/16".

H. Field-welded headed shear connectors shall be inspected and tested according to requirements of AWS D1.1 for stud welding, proper stud height, and as follows:

1. Headed shear connectors shall be visually inspected to verify the presence of a continuous 360-degree weld flash. Bend tests will be performed by bending to an angle of 15 degrees from vertical when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any headed shear connector.
2. Ten percent of headed shear connectors, including those which do not pass the visual inspection described above and additional connectors selected at random, shall be tested by bending to an angle of 15 degrees from vertical. Connectors which pass the bend test may be left in the bent position.
3. Bend tests will be conducted on the adjacent headed shear connectors on each side when weld fracture occurs on a headed shear connector.

I. Masonry reinforcing steel which is field welded to structural steel shall be inspected as follows:

1. Verify that all reinforcing steel which is to be welded conforms to ASTM A 706.
2. At each beam or other structural steel member, the first welded reinforcing bar shall be bent to an angle of 30 degrees and then bent back into place. Before being covered with masonry, all reinforcing bars shall be hit with a hammer after welding to verify that welds do not fracture.

2.6 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

B. Galvanized Surfaces: All exposed galvanized surfaces which have been damaged by shipping, handling, welding or other operations shall be repaired. Surfaces to be repaired shall be clean, dry, and free of oil, grease, welding slag or flux and corrosion products. Apply galvanizing repair paint according to the manufacturer's instructions to attain the required dry-film thickness. END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes steel joists and joist accessories. The term “joist” in this section refers to openweb K-series joists, joist substitutes, longspan joists, and deep longspan joists. B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for installing bearing plates in concrete.
2. Division 4 Section "Unit Masonry" for installing bearing plates in unit masonry.
3. Division 5 Section "Structural Steel Framing" for coordinating joist connections to structural steel.

1.3 SUBMITTALS

A. General: Submit the following in accordance with conditions of the Contract and Division 1 Specification Sections.

B. Fabricator Qualifications: Submit documentation that the joist fabricator is a member of the Steel Joist Institute (SJI) and is certified by SJI to manufacture joists complying with SJI’s “Specifications”.

C. Product Data: For each type of joist, accessory, and product indicated, submit manufacturer’s certification of compliance with SJI’s "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, "Specifications").

D. Shop Drawings: Show layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details; bracing; bridging and bridging connections; accessories; splice and connection locations and details; and attachments to other construction. Indicate uplift loads and any other special loads for which joists are designed.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.4 QUALITY ASSURANCE

A. Comply with SJI’s “Specifications”.

B. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project with a record of successful in-service performance. Manufacturer must be certified by SJI to manufacture joists complying with SJI’s “Specifications”.

C. Field Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel"; and AWS D1.3 "Structural Welding Code - Sheet Steel."

D. High Strength Bolting: Comply with Research Council on Structural Connections (RCSC) “Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts.”

E. Inspection: Manufacturer shall inspect joists before shipment to ensure compliance with SJI’s “Specifications”.

F. Codes and Standards: Applicable editions of codes and standards shall be the editions specified in the Building Code edition in effect for this Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications".

B. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

C. High-Strength Bolts and Nuts: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain, uncoated.

D. Welding Electrodes: Comply with AWS standards.

2.2 PRIMER

A. Primer: Manufacturer's standard shop primer complying with performance requirements of SSPCPaint 15.

2.3 JOISTS

A. Design and manufacture steel joists to comply with SJI’s "Specifications" and “Recommended Code of Standard Practice for Steel Joists and Joist Girders,” and the erection requirements of OSHA “Steel Erection Standard 29 CFR Part 1926.757, Open Web Steel Joists”.

1. Design joists for uniform loads indicated in the SJI Load Tables and any special loads and criteria indicated on the Drawings.

2. Design joists for the additional stresses resulting from a 300-pound concentrated load located at any location along the top and bottom chord. The 300-pound load is already accounted for in the joist designations shown on the drawings unless noted otherwise and shall be applied concurrently with the balance of the standard SJI service load.
3. Design roof joists for net uplift of 20 psf unless otherwise indicated. B. Do not increase allowable stresses for wind load combinations.

C. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

D. Camber joists in accordance with SJI's "Specifications."

E. Equip bearing ends of joists with beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

F. Where joists are supported by steel columns or are bolted to steel framing, or where stabilizer plates are required for bottom chords, the manufacturer shall coordinate the details with the structural steel supplier.

G. Top Chord Extended Ends: Extend top chords where indicated. Design extended ends to support the uniform load indicated in the SJI Load Tables for the span of the joist unless a larger design load is indicated.

H. Ceiling Extensions: Provide ceiling extensions in areas having ceilings or gypsum board construction attached directly to joist bottom chords and other locations where indicated. The extension shall be of sufficient strength to support the ceiling and shall be extended to within 1/2 inch of the finished wall surface.

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Bridging shall comply with OSHA "Steel Erection Standard 29 CFR Part 1926.757, Open Web Steel Joists".

1. Provide uplift bridging consisting of a single line of bottom chord bridging at the first bottom chord panel point at each end of joists on all roof joists.

2. Furnish additional erection stability bridging where required.

3. On diagonal bridging, provide bolted connections to joist chords and at intersections of bridging. Bolts shall be ASTM A 307 of size indicated in SJI "Recommended Code of Standard Practice for Steel Joists and Joist Girders."

4. Provide bolted diagonal bridging for all bridging on deep longspan joists.

5. In rows of diagonal bridging, provide horizontal bridging in end joist spaces unless otherwise indicated.
6. Ends of all bridging lines, including uplift bridging must be anchored.

B. Provide header units to support tail joists at openings not framed with structural steel shapes.

C. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from joists and accessories by hand-tool cleaning, SSPC-SP 2.

B. Apply one shop coat of primer to joists and joist accessories to provide a continuous, dry paint film thickness not less than 1 mil thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting construction, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after supporting construction is in place and secured and unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI "Specifications," joist manufacturer's field use shop drawings, and requirements in this Section, unless more stringent fastening requirements are indicated on the drawings.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately before permanently fastening.
3. Install bridging, temporary bracing, connections, and anchors to ensure that joists are stabilized during construction. Erection shall comply with OSHA “Steel Erection Standard 29 CFR Part 1926.757, Open Web Steel Joists.”
4. Where rigid connections of bottom chord extensions to columns or supports are indicated, delay making rigid connection until dead loads have been applied.

B. Field Welded End Anchorage: Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

C. Bolted End Anchorage: Provide bolted end anchorage for joists where indicated or required.

1. Bolt joists to supporting steel framework using carbon-steel bolts, unless otherwise indicated.
2. Bolt joists to supporting steel framework using high-strength structural bolts where indicated. Comply with RCSC's "Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

D. Bridging: Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at walls or beams.

1. Connect horizontal bridging to each joist and bridging anchor with a minimum 1/8" fillet weld, 1/2 inch long at K-series and KCS-series joists, and with a minimum 1/8" fillet weld, 1 inch long at longspan joists. Splice horizontal bridging with two welds as indicated above, one weld on each leg of the bridging angle. In rows of diagonal bridging, where horizontal bridging is provided in end joist spaces, weld the horizontal bridging to the bridging anchor with a minimum two 1/8" fillet welds, 1inch long, one on each side of the bridging angle.
2. On diagonal bridging, provide bolted connections as indicated in SJI "Recommended Code of Standard Practice for Steel Joists and Joist Girders."
3. Joist bridging shall not be used to support piping, ducts, conduits, ceilings or any other item.

E. Before field painting commences, remove all joist tags and their connecting wires or strings from joists which will be exposed to view in the finished structure.

3.3 FIELD QUALITY CONTROL

A. Special Inspector: Owner will engage a special inspector to perform field quality control inspections of joist connections to the structure:

1. Visually inspect welds and weld size where joists are attached to the structure for conformance with approved shop drawings.
2. Approximately ten percent of joist connections to the structure, selected at random by the special inspector, shall be visually inspected. If unacceptable connections are found, the joist connections on the joists at each side of the unacceptable connection shall also be inspected.

B. Special inspector will report results of inspections promptly to Architect and Contractor.

C. Repair connections not in compliance with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Misfabricated or Damaged Joists: Misfabricated or damaged joists shall be replaced or repaired. Before joists are repaired, the manufacturer shall submit for review details of the proposed repair method, approved, stamped, and signed by a qualified structural engineer licensed to practice in the state where the project is located. After the repair is complete, the joist supplier shall provide a written statement verifying that the capacity of the repaired joists is at least equivalent to the originally specified joists. For joists which will be exposed to view in the final structure, the appearance of the repaired joist must be acceptable to the architect.

B. Maintain conditions that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.
2. Acoustical roof deck.
3. Accessories.

1.3 SUBMITTALS

A. General: Submit the following in accordance with conditions of the Contract and Division 1 Specification Sections.

B. Product Data: For each type of accessory indicated, submit details and thicknesses. For each type of deck, submit structural properties, thicknesses, and maximum unshored construction spans.

C. Underwriters' Label: Where compliance with a UL fire-rated assembly is required as indicated on the architectural drawings, provide certification that steel deck units are identical to those units tested for fire resistance per ASTM E 119 and listed in Underwriters' Laboratories "Fire Resistance Directory".

D. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing details, deck openings, special jointing, and accessories.

E. Welding Certificates: Copies of certificates for welding procedures and personnel.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck installations similar to this Project with a record of successful in-service performance.

B. Testing Agency Qualifications: An independent testing agency, acceptable to the Architect, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

C. AISI Specifications: Calculate structural properties of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

D. Underwriters' Label: Where compliance with a UL fire-rated assembly is required as indicated on the architectural drawings, provide steel deck units identical to those units tested for fire resistance per ASTM E 119 and listed in Underwriters' Laboratories "Fire Resistance Directory".

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
   1. For deck profiles with field-installed insulation, protect insulation strips from moisture.

1.6 COORDINATION

A. Coordinate installation of acoustical deck containing sound-absorbing insulation strips with roofing installation to ensure protection of insulation strips against damage from effects of weather, moisture, and other causes. Do not allow insulation strips to become wet.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers whose products may be included in the Work include, but are not limited to, the following:

   1. New Millennium Building Systems.
   2. Epic Metals Corp.
   3. United Steel Deck, Inc.
   4. Vulcraft, Division of Nucor.
   5. Wheeling Corrugating Co.

2.2 GENERAL

A. Deck which is to receive spray-applied fireproofing shall be free of lubricants and oils which would impair the adhesion of the fireproofing. The deck manufacturer shall certify that the deck is UL classified and has been fire tested with the appropriate fireproofing material.

B. For galvanized deck which is to be field painted, contractor shall coordinate with the decking supplier prior to ordering to verify that all exposed decking schedule to be painted has a paintcompatible passivator that does not inhibit proper bonding of the paint per the painting manufacturer.

2.3 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 minimum, G60 zinc coating.
2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 minimum, G60 zinc coating. Bottom surface shop primed after galvanizing with manufacturer's standard gray or white baked-on lead-free and chromate-free rustinhibitive primer complying with performance requirements of FS TT-P-64.
3. Deck Profile Type, Depth, Thickness and Structural Properties: As indicated on the structural drawings.
4. Side Laps: Overlapped.

2.4 ACOUSTICAL ROOF DECK

A. Acoustical Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and the following:

1. Galvanized and Shop-Primed Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33 minimum, G60 zinc coating. Bottom surface shop primed after galvanizing with manufacturer's standard gray or white baked-on lead-free and chromate-free rustinhibitive primer.
2. Deck Profile Type, Depth, Thickness and Structural Properties: As indicated on the structural drawings.
3. Side Laps: Overlapped.
4. Acoustical Perforations: Deck units with manufacturer's standard perforations.
5. Sound-Absorbing Insulation: Manufacturer's standard premolded roll or strip glass fiber or mineral fiber installed in each deck rib.

2.5 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Screws: Corrosion-resistant, hexagonal washer head, self-drilling carbon-steel screws.

C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33 ksi, not less than 0.0358-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

D. Welding Washers for use with Non-Composite Form Deck: Steel sheet with a minimum thickness of 0.0598 inches (16 gage), with a nominal 3/8 inch diameter hole.

E. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (14 gage) thick, of same material and finish as deck, with 3-inch-wide flanges and recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

F. Column Closures, End Closures, Z-Closures, Girder Fillers and Cover Plates: Steel sheet, of same material and finish as deck, not less than 0.0358-inch design uncoated thickness. G.

Galvanizing Repair Paint: ASTM A 780 or SPC-Paint 20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting members and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section and on the drawings.

B. Fabricate deck panels in lengths to span three or more supports where possible.

C. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

D. Locate decking bundles to prevent overloading of supporting members.

E. Place deck panels and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side-lap interlocks.

F. Place deck panels flat and square and fasten to supporting members without warp or deflection.

G. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

H. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

I. All screws should penetrate the joined materials so that there are not less than 3 exposed threads. Screws should be installed and tightened in accordance with the screw manufacturer’s recommendations.

J. Install mechanical fasteners according to deck manufacturer's instructions.

3.3 ROOF DECK INSTALLATION

A. Screw roof deck panels to all perimeter angles and to all steel supporting members with selfdrilling No. 12 diameter or larger carbon-steel screws as follows:

1. Space screws 6 inches apart at each support and at entire perimeter.
2. Space screws as indicated on the structural drawings, or if not indicated, at 6 inches apart at each support and at entire perimeter.

B. At perimeter angles and steel supporting members which are too thick to fasten deck by screwing, substitute arc spot (puddle) welds of 5/8 inch minimum diameter at the same spacing as indicated for screws.

C. Side-Lap Fastening: Fasten side laps of panels between supports at intervals as indicated, but not exceeding the lesser of 1/2 of the span or 36 inches, and as follows:

1. Mechanically fasten with No. 10 diameter or larger screws.

D. End Bearing: Install deck ends over supports with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Butt end joints in cellular deck and other deck profiles that cannot be lapped. Lap end joints of all other roof deck types 2 inches minimum.

E. Do not allow insulation in acoustical roof deck ribs to become wet or moist.

F. Miscellaneous Roof Deck Accessories: Install finish strips, cover plates, and closures according to deck manufacturer's instructions. Attach to substrate to provide a complete deck installation.

G. Roof deck shall not be used to suspend piping, ducts, conduits, ceilings or any other item.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field quality control inspections of roof deck connections:
1. Visually inspect screw size and spacing of roof deck connections to structure.
2. Visually inspect screw size and spacing in side laps of roof deck.

B. Special inspector will report results of inspections promptly to Architect and Contractor.

C. Provide additional connections to replace connections not in compliance with specified requirements.

3.5 REPAIRS, REINFORCEMENT AND PROTECTION

A. Galvanizing Repairs: Prepare and repair rust spots, welds, burned areas, and damaged areas of galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Reinforcement of Openings: Unless other reinforcing is shown on the structural drawings, reinforce openings with any dimension larger than 6 inches as follows

1. Openings 6 inches to 12 inches: Reinforce with 0.0358-inch steel sheet, 6 inches wider than opening in all directions. Attach to top surface of deck with No. 10 diameter screws or welds at 6 inch spacing along each side. Attach to deck before opening is cut.
2. Openings 12 inches to 18 inches: Reinforce with 2 inch x 2 inch x 1/4 inch steel angles. Place angles perpendicular to flutes, extended minimum two flutes each side of opening. Weld to top surface of deck with welds at 6 inch spacing along each side of angles. Attach to deck before opening is cut.
3. Where openings are in deck supporting slabs, provide pour stops around openings in addition to reinforcing indicated above. Cut deck out of opening after concrete has been in place a minimum of seven days.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior non-load-bearing wall framing.
2. Exterior soffit and fascia framing.
3. Bracing for top of exterior storefront at entries.
4. Exterior ceiling joist framing.
5. Other items indicated on the structural drawings to be by the light gage framing supplier (or the synonymous term cold-formed framing supplier). B. Related Sections include the following:

1. Division 5 Section "Structural Steel Framing" for masonry shelf angles.
2. Division 9 Section "Gypsum Board Assemblies" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
3. Division 9 Section "Gypsum Board Shaft-Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads and Criteria: As indicated on the structural drawings.

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

   a. Exterior Wall Framing: Horizontal deflection of 1/600 of the wall height for walls with brick or other masonry veneer. 1/360 for walls with other types of cladding. For purposes of deflection calculations, the wind load may be taken as 0.7 times the components and cladding 50-year wind loads in the applicable code. Strength calculations must be based on the full components and cladding 50-year wind loads.
   b. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for total load.

3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of 3/4 inch.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design exterior wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1. Include structural analysis data signed and sealed by the qualified professional

engineer responsible for their preparation. C. Welding certificates. D. Qualification Data:

For professional engineer.

E. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Expansion anchors.
2. Power-actuated anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.

1.5 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated for this Project.

C. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering coldformed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 MATERIALS

A. Steel Sheet: ASTM A 1003, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: As required by structural performance.
2. Coating: G60.

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (18 gage), except studs to which exterior storefront, curtain wall or windows are attached shall be 16 gage minimum.
2. Flange Width: 1-5/8 inches.
3. Section Properties: As required to meet the structural design criteria.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs, except tracks to which exterior storefront or curtain wall is attached shall be 16 gage minimum.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, as appropriate for the application, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dietrich Metal Framing; a Worthington Industries Company.
b. MarinoWare, a division of Ware Industries.
c. SCAFCO Corporation
d. The Steel Network, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (18 gage).
2. Minimum Flange Width: 1 inch plus the design gap.

2.4 SOFFIT, FASCIA, AND CEILING JOIST FRAMING

A. Steel Framing: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (18 gage), except studs and tracks to which exterior storefront or curtain wall is attached shall be 16 gage minimum.
2. Flange Width: 1-5/8 inches.
3. Section Properties: As required to meet the structural design criteria.

B. Where framing is for backup of composite metal panels, provide continuous 2” x 2” x 18 gage angles at all corners.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Gusset plates.
7. Stud kickers, knee braces, and girts.
8. Joist hangers and end closures.
9. Hole reinforcing plates.
10. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, and carbonsteel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere. F.

Welding Electrodes: Comply with AWS standards.

2.7 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads. Unless larger dimensions are indicated on Shop Drawings, ¾" minimum clearance shall be maintained between screws and edges of members, and ¾" minimum oncenter spacing shall be maintained between adjacent screws.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum outofsquare tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, zees, supplementary framing, or tracks to structural members indicated to receive sprayed fireresistive materials. The engineered shop drawings and calculations shall include the design of these members and their connections.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fireresistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fireresistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening. Wire tying of framing members is not permitted.

   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads. Unless larger dimensions are indicated on Shop Drawings, ¾" minimum clearance shall be maintained between screws and edges of members, and ¾" minimum oncenter spacing shall be maintained between adjacent screws.

D. In multistory buildings, do not install wall studs until the concrete slabs above and below the studs have been poured.

E. Install framing members in one-piece lengths unless splice connections are indicated.

F. Install manufactured connectors in accordance with the manufacturer's recommendations. The size and number of fasteners shall be as specified by the manufacturer.

G. Framing around openings where windows, curtain wall, storefront, and louvers in exterior walls (headers, jambs, sills) are attached shall be 16 gage minimum.

H. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

I. At exterior walls where wall stud framing is interrupted by steel beams and wall sheathing or insulation boards run continuous past the beam, provide vertical stud infill framing in the exterior sides of webs of beams at the same spacing as the wall studs. Minimum base metal thickness shall be not less than minimum base metal thickness required for exterior wall studs in this specification. Infill framing is required whether shown on the drawings or not.

J. Do not bridge building expansion joints with cold-formed metal framing. Independently frame both sides of expansion joints.

K. Install insulation, specified in Division 7, in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

L. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

M. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom tracks, except where deflection tracks are used. Space studs as follows:

1. Stud Spacing: 16 inches, except where otherwise indicated or where closer spacing is required by the engineering analysis.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single-leg deflection tracks and anchor to building structure.
2. Connect vertical deflection clips to bypassing studs and anchor to building structure.
3. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs spaced in rows not more than 48 inches apart using one of the methods below. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
2. Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Combination of flat, taut, steel sheet straps of width and thickness indicated and studtrack solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
4. Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install headers, sills, and jamb studs at openings as required to resist wind and seismic loads and to transfer these loads to the structure.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wallframing system.

3.5 SOFFIT, FASCIA, AND CEILING JOIST INSTALLATION

A. Provide light gage framing for soffits, fascia, and exterior ceilings as indicated on the architectural and structural drawings. All required items may not be shown on the structural drawings.

1. Dimensions and details shall be as shown on the architectural drawings.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a special inspector to perform tests and inspections and prepare test reports.

B. Special inspector shall verify in the field that the following is in accordance with the Drawings and approved shop drawings:

1. Member sizes, configurations, and spacings.
2. Connections.
3. Bracing and bridging.
4. Shear wall panel construction including holdowns.

C. Special inspector will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results or inspections indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. The extent of miscellaneous metal work is shown on the drawings and includes items fabricated from iron steel shape, plates, bars, strips, tubes, cables, pipes and castings which are not a part of the structural steel or other metal systems in other sections of these specifications, and miscellaneous aluminum items and shapes. Includes those components shown on the architectural drawings. Contractor is to provide regardless of whether actual size is indicated or not. Any missing size must be confirmed with the architect and provided at no additional cost.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 04 2731 - Reinforced Unit Masonry: Placement of metal fabrications in masonry.

D. Section 05 5113 - Metal Pan Stairs.

E. Section 05 5116 - Metal Floor Plate Stairs.

F. Section 05 5213 - Pipe and Tube Railings.

G. Section 09 9113 – Exterior Paint.

H. Section 09 9123 – Interior Paint.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2005.

B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2002.

C. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2008.

D. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.

E. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.

F. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

G. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2003 (Reapproved 2007).

H. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2009a.

I. ASTM A 325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2009.

J. ASTM A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2007.

K. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

L. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

M. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2008.

N. ASTM B 221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2007.

O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

Q. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; American Welding Society; 2003, and Errata 2004.

R. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

S. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

T. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004). 1.04 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS - GENERAL

A. For the fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

B. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

C. Materials shall be free from defects impairing strength, durability and appearance and of the best commercial quality.

2.02 MATERIALS - STEEL

A. Steel Sections: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 501 hot-formed structural tubing.

C. Plates: ASTM A 283.

D. Steel Bars and Bar Size Shapes: ASTM A306, Grade 65, or ASTM A36.

E. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, hot-dip galvanized finish.

F. Slotted Channel Framing: ASTM A 653, Grade 33.

G. Slotted Channel Fittings: ASTM A 1011/A 1011M.

H. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, galvanized to ASTM A 153/A 153M where connecting galvanized components.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type II - Organic, Level 1, Type III zinc dust complying with VOC limitations of authorities having jurisdiction.
   1. Galvanizing Repair Paint shall be ZRC Galvilite as manufactured by ZRC Worldwide or approved equal.

2.03 MATERIALS - GRAY IRON CASTINGS A.

ASTM A48, Class 30.

2.04 MATERIALS - MALLEABLE IRON CASTINGS: A. ASTM A47, Grade as selected.

2.05 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B 221 (ASTM B 221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B 209 (ASTM B 209M), 5052 alloy, H32 or H22 temper.

C. Bolts, Nuts, and Washers: Stainless steel.

D. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.06 ACCESSORIES

A. Masonry Anchorage Devices: Hilti "Sleeve Expansion Anchors" or Hilti "HAS Adhesive Anchors" as indicated or approved equal.

B. Toggle Bolts: Tumble wing type: FS FF B 588, a type, class and style as required.

C. Fasteners: Provide zinc coated fasteners, with galvanizing complying with ASTM A153, for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required for the installation of miscellaneous metal items.

D. Welding Materials: Provide the type and alloy of filler metal and electrodes in compliance with the recommendations of the producer of the metal to be welded and as required for color match, strength and compatibility in the fabricated items.

2.07 FABRICATION

A. Field measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the work.

B. Form Exposed Work: True to line and level with accurate angles and surfaces and straight sharp edges.

C. Fit and shop assemble items in largest practical sections, for delivery to site.

D. Fabricate items with joints tightly fitted and secured.

E. Continuously seal joined members by continuous welds.

F. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

G. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

H. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

I. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
   1. Provide setting drawings, templates, instructions and directions for installation of anchorage devices such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery with other work to avoid delay.

J. Shop Painting: Shop paint miscellaneous metal work, except members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded and galvanized surfaces, unless otherwise specified. Apply one shop coat of lead-free rust inhibitive alkyd metal primer to fabricated metal items, except apply two coats of paint to surfaces inaccessible after assembly or erection.

2.08 FABRICATED ITEMS

A. Ladders at Roofs: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; galvanized and primed finish.
   1. Side Rails: 3/8 x 2 inches members spaced at 20 inches.
   2. Rungs: one-inch diameter solid round bar spaced 12 inches on center.
   3. Space rungs 7 inches from wall surface.
   4. Wall Brackets: 2 inches (50 mm) by 1/4 inch (6 mm) minimum flat bar steel wall brackets.
   5. Floor Brackets: Anchor side rails to floor with 2 by 1/4 inch (50 by 6 mm) minimum flat bar steel floor brackets. Allow 7 inches (180 mm) minimum clearance from wall to center line of rungs.

C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish. Painted – color as selected by architect.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, and masonry; galvanized finish.

E. Lintels: As detailed; galvanized finish. See structural drawings for lintel schedule.

F. Sill Angles/plates for Tempered Glass Railing Assemblies: ASTM A 36/A 36M steel angles/plates with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, prime paint finish.

G. Carpenter's Iron Work: Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork and for anchoring or securing woodwork to concrete or other structures. Manufacture or fabricate items of sizes, shapes and dimensions required. Furnish malleable iron washers for head nuts which bear on wood structural connections, elsewhere, furnish steel washers.

J. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

K. Stair Nosing: Cast Aluminum Safety Nosing with standard abrasive cross-hatch finish, three inches wide and terminating six inches from end of tread. Complete with strap-anchors or

integrally cast anchors 12 inches o.c. for embedding into concrete with top flush with tread surface. Provide at all exterior concrete stairs.

2.09 FINISHES - STEEL

A. Prime paint all steel items.
   1. Exceptions: Galvanize items to be embedded in concrete or masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing. B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A 123/A 123M requirements. Provide minimum 2.0 oz/sq ft galvanized coating. Grade 85.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A 123/A 123M requirements.

2.10 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: high performance organic coating.

B. Interior Aluminum Surfaces: high performance organic coating.

C. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as selected from manufacturer's standard colors.

D. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.11 FABRICATION TOLERANCES

A. Squareness: 1/8-inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation from Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot dip galvanized after fabrication and are intended for bolted or screwed field connections.

C. Do not cut or abrade members with finishes which cannot be completely restored in the field. Where cutting, welding and grinding are required for fitting and jointing of the work, restore finishes to eliminate any evidence of such corrective work.

D. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments. E. Field weld components indicated.

F. Perform field welding in accordance with AWS D1.1/D1.1M.

G. Obtain approval prior to site cutting or making adjustments not scheduled.

H. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Rooftop equipment bases and support curbs.
2. Wood blocking**,** cants, and nailers.
3. Wood sleepers.
4. Plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all indicated rough carpentry items and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with firetestresponse characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flamespread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fireretardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all built into walls and roof that is structural in nature or as indicated on Drawings.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Eastern softwoods; No. 2 Common grade; NeLMA.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking,and similar supports to comply with requirements for attaching other construction.

B. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.2 PROTECTION

A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Division 01 - General Requirements, and other applicable specification sections in the Project Manual apply to the work specified in this Section.

1.02 SUMMARY

A. SCOPE: This section covers all architectural woodwork shown on the drawings and specified herein, complete. Architectural woodwork includes all woodwork exposed to view in finished building, except as exempted in paragraph entitled "Related Work Specified in Other Sections" and includes, but not necessarily limited to, the following:

1. Interior standing and running trim. See drawings also.
2. Flush wood paneling.
3. Wood cabinets.
4. Solid Surface Material.
5. Reflective surface material6. Shop finishing of woodwork.

B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips unless concealed within other construction before woodwork installation. Coordinate concealed blocking needed for installation with General Contractor. Exposed fasteners not allowed.

1.03 RELATED WORK SPECIFIED IN OTHER SECTIONS: The following related work is specified under other sections of the specifications:

A. Rough Carpentry
B. Wood doors, except casework and cabinetry doors
C. Hardware, except those items specifically included for casework and cabinetry.
D. All casework and cabinetry listed as High Pressure/Melamine modular casework.

1.04 REFERENCES

A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

B. American Wood Council (AWC):
1. AWC DCA, "Design for Code Acceptance."

C. Architectural Woodwork Institute (AWI):
1. AWI AWS, "Architectural Woodwork Standards."

D. ASTM (ASTM):
1. ASTM D 523, "Standard Test Method for Specular Gloss."
2. ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."

E. Forest Stewardship Council (FSC):
1. FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

F. Hardwood Plywood and Veneer Association (HPVA):
1. ANSI/HPVA HP-1, "American National Standard for Hardwood and Decorative Plywood" (copyrighted by HPVA, ANSI approved).
2. HPVA HPH, "Hardwood Plywood Handbook."
3. HPVA VSG, "Veneer Species Guide."

1.05 SUBMITTALS:

A. Product Data: For solid-surfacing material, cabinet hardware and accessories, and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. C. Samples (4 ea. samples):

1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
2. Hardware and finishes.
3. Solid surface countertop material.

D. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.06 QUALITY ASSURANCE:

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful inservice performance.

1. Shop Certification: AWI's Quality Certification Program accredited participant.

B. Installer Qualifications: Fabricator of products, AWI's Quality Certification Program accredited participant.

C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards."

1. Provide AWI Quality Certification Program labels and certificates for woodwork, including installation.

D. Pre-Installation Conference: Conduct pre-installation conference in accordance with Section 01 3119 - Project Meetings. Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Mock-ups shall be reviewed during the pre-installation conference. Pre-installation conference shall include, but shall not be limited to, the Contractor, the Installer, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Architect

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.08 MOCK UP

A. Mock-Ups: Prior to installation of the work, fabricate and erect mock-ups for each type of finish and application required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups using materials indicated for final unit of work.

PART 2 PRODUCTS

2.01 WOODWORK FABRICATORS:

A. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by one of the following:

2.02 MATERIALS:

A. Wood Species and Cut for Transparent Finish:
1. Grade: AWI Premium
2. Species: Pure Clear White Maple
3. Cut: Flat-Cut
4. Matching: Book Matched – Balance & Center Matched
5. Finish: Transparent Finish Stained to match sample supplied by Architect. Run Grain Vertically on Vertical Surfaces (Typ.).

B. Wood Products:
1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea-formaldehyde.
3. Softwood Plywood: DOC PS 1, Medium Density Overlay.
4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea-formaldehyde.

C. Solid Surface Material: Solid Surface Material, by Wilsonart. Colors T.B.D. by Architect from Manufacturer's Grade Five. Slab cut to size and shapes required. See drawings.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: a. Dupont
   b. Wilsonart
   c. Formica

D. Reflective surface material where specified shall be Formica brand solid metal by Formica Corp; or prior approved equal by Architect.

2.03 CABINET HARDWARE AND ACCESSORIES:

A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening.

C. Back-Mounted Pulls: BHMA A156.9, B02011. As indicated on the drawings.

D. Catches: Spring Action Push-In Magnetic Latches, BHMA A156.9, B03131

E. Drawer Slides: BHMA A156.9, B05091.
1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.

F. Door Locks: BHMA A156.11, E07121 to be located on all doors. One key is to operate all locks.

G. Drawer Locks: BHMA A156.11, E07041 to be located on all drawers, one key to operate all locks.

H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630 unless indicated otherwise on the drawings.

2.04 MISCELLANEOUS MATERIALS:

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Adhesives, General: Do not use adhesives that contain urea-formaldehyde.

2.05 FABRICATION:

A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.

1. Interior Woodwork Grade: *Premium*.
2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish. B. Interior Standing and Running Trim:

1. For transparent-finished trim items wider than available lumber, use veneered construction. Do not glue for width.
2. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
3. Assemble casings in plant except where limitations of access to place of installation require field assembly.
4. Provide as indicated on the drawings. C. Flush Wood Paneling:

1. Lumber Trim and Edges: At fabricator's option, trim and edges indicated as solid wood (except moldings) may be either lumber or veneered construction compatible with grain and color of veneered panels. Hardwood edges: 3mm thick.
2. Architectural grade pure Clear White Maple Veneer.
3. Matching of Adjacent Veneer Leaves: Book Matched – Balance & Center Match
4. Veneer Matching within Panel Face: Book Matched – Balance & Center Match
5. Panel-Matching Method: In each separate area, use sequence-matched, uniform-size sets.
6. Wood Grain to run vertically on vertical surfaces. D. Wood Cabinets for Transparent

Finish:

1. AWI Type of Cabinet Construction: Flush overlay.
2. Reveal Dimension: As indicated.
3. Architectural grade pure Clear White Maple Veneer.
4. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
6. Matching of Veneer Leaves: Book Matched – Balance & Center Match
7. Veneer Matching within Panel Face: Book Matched – Balance & Center Match
5. Semi-exposed Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
6. Drawer and Door hardwood edges (3mm thick) to be attached prior to laminating the face and back.
7. Drawer Sides and Backs: Solid-hardwood lumber, same species indicated for exposed surfaces.
8. Drawer Bottoms: Thermoset decorative panels.
9. Cabinet Interior to be Clear White Maple Veneer (Typ.)
10. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

E. Solid Surfacing wall base and window sills: Thickness is to be 3/4 inch minimum. Color to be selected by architect from manufacturer's full range of colors. Fabricate all window sills with the lip edge where indicated. The lip must extend ½" past vertical wall treatment. Color caulk all perimeters. Color as selected by architect from samples submitted by the contractor.

2.06 SHOP FINISHING:

F. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

G. Back-priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling. H. Transparent Finish:

1. Grade: *Premium*.
2. AWI Finish System: TR-2, Catalyzed lacquer. 3. Staining: Match two (2) Color samples. Note: one stain "S-1" will be light in color, the other "S-2" an accent will be darker in color.
4. Wash Coat for Stained Finish: Apply a wash-coat sealer to woodwork made from closedgrain wood before staining and finishing.
5. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 EXECUTION

3.01 INSTALLATION:

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.

B. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Shim as required with concealed shims.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Scarf running joints and stagger in adjacent and related members. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.

G. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening, unless covered by trim.

H. Cabinets: Install without distortion so doors and drawers' fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

END OF SECTION 06 4023

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet membrane waterproofing and foundation wall drainage systems complete.

B. Cant strips and other accessories.

C. Drainage panels.

D. Vapor Barriers for all ground floor slabs on grade.

E. Sheet membrane waterproofing system for all walls below grade, and elsewhere as shown on drawings.

F. Sheet membrane waterproofing system for under the wood floor systems.

G. Sheet membrane waterproofing system for elevator pits, stage perimeter walls, walls at change in floor slab heights and other wall areas inside of the building exterior below grade that are not indicated to connect to the storm drain

H. Liquid Elastomeric waterproofing membrane at interior side of interior and exterior raised planters.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-In-Place Concrete: Concrete substrate.

B. Section 04 2000 - Unit Masonry: Masonry substrate.

C. Section 31 2000 - Earthwork:

D. Section 31 2333 - Trenching and Backfilling: Backfilling and compacting.

E. Section 33 4600 - Subdrainage: Retaining wall subdrainage system and foundation wall drainage information.

1.03 REFERENCE STANDARDS

A. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension; 2006a.

B. ASTM D 570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2005).

C. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

1.04 SUBMITTALS

A. See Section 01-3300 - Submittal Procedures.

B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, protection board, drain mat, piping to storm drain and any other materials or system components required for a COMPLETE system.

C. Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures. E. Warranty:

1. Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
2. Submit two copies of warranty for the waterproofing work agreeing to repair or replace the system components which leak water, deteriorates excessively or otherwise fails to perform as required within the warranty period due to failure of materials of workmanship. By terms of warranty, also agree to remove and replace other work

which has been superimposed on the waterproofing work. Warranty shall be signed by Contractor and by the Installer. Warranty shall be for a period of two years from date of substantial completion of the project.

1.05 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in waterproofing sheet membranes with ten (10) years' experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years' experience in similar work and approved by the manufacturer.

C. Materials: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field operations to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work. Agenda for meeting shall include review of special details and flashing.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations. B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.08 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

B. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.

C. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.

1.09 WARRANTY

A. See Section 01 7839 - Project Record Documents for additional warranty requirements.

B. Contractor shall correct defective Work within a five (5) year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner. This no cost replacement of any landscaping or plantings shall provide plantings of same size as those removed if directed by owner or architect.

C. Provide five (5) year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

D. The Contractor and Installer shall warrant the waterproofing work agreeing to repair or replace the system components which leak water, deteriorates excessively or otherwise fails to perform as required within the warranty period due to failure of materials of workmanship. By terms of warranty, also agree to remove and replace other work which has been superimposed on the waterproofing work. Warranty shall be signed by Contractor and by the Installer. Warranty shall
be for a period of two years from date of substantial completion of the project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Laminated Composite Manufacturers:
   1. Grace Construction Products; Product Bituthene 4000 System: www.na.graceconstruction.com.
   2. Polyguard Products, Inc; Product: Polyguard 650 System: www.polyguardproducts.com.
   3. W.R. Meadows, Inc; Product Mel Rol System: www.wrmeadows.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MEMBRANE MATERIALS

A. Membrane shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Composite Laminate Membrane: Comprised of 1.4mm (0.056 inch) (thickness of rubberized asphalt and a thickness of 0.1 mm (0.004 in.) of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner.; 0.060-inch total thickness. Provide rubberized asphalt membrane covered with a release sheet which is removed during installation. No special adhesive or heat shall be required to form laps.
   1. Flexibility: 180-degree bend over 1-inch mandrel at -45 degrees F in accordance with ASTM D 1970 - Unaffected.
   2. Tensile Strength: 325 psi, measured in accordance with ASTM D 412.
   3. Ultimate Elongation: 300 percent, measured in accordance with ASTM D 412.
   4. Crack Cycling at -25 degrees F, 100 cycles, in accordance with ASTM C 836 - Unaffected
   5. Lap Adhesion at minimum application temperature: 5 lbs/in in accordance with ASTM D 1876.
   6. Peel Strength: 9 lbs/in in accordance with ASTM D 903.
   7. Puncture Resistance, Membrane: 50 lbs minimum in accordance with ASTM E 154.
   8. Resistance to Hydrostatic Head: 231 ft of water in accordance with ASTM D 5385.
   9. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D 570, 24-hour immersion.
   10. Water Vapor Permeability: 0.05 perm inch, measured in accordance with ASTM E 96/E 96M.

C. Seaming Materials: As recommended by membrane manufacturer.

D. Membrane Sealant: As recommended by membrane manufacturer.

E. Surface Conditioner, Mastic and Liquid membrane: As recommended by manufacturer, compatible with membrane.

F. Liquid Membrane at planters: Masterseal HLM 5000R (roller applied) elastomeric waterproofing liquid membrane by BASF or equal.

2.03 ACCESSORIES

A. Drainage Panel: 0.433-inch-thick geo-composite drainage sheet system consisting of a hollow studded polystyrene core, covered on one side with a nonwoven, needle punched polypropylene filter fabric and on the other side with a smooth polymeric film, designed to promote positive drainage while serving as a protection course. Hydroduct 220 manufactured by Grace Construction Products or approved equal.
   1. Drainage panel shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

2. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. B. Cant Strips: Pre-molded composition material.

C. Tape and accessories: Products acceptable to manufacturer of sheet membrane waterproofing.

D. Waterstop: See Section 03 3000 - Cast-In-Place Concrete.

E. Drain pipe for tying into nearest storm drain shall be as recommended by drainage system manufacturer to ensure a “complete” system. See section 33 4600 for additional information.

2.04 VAPOR BARRIERS A. Membrane under all floor slabs on grade shall be VaporBlock 15 Class

“A” by Raven Industries,

StegoWrap 15 Class “A”, or approved equal. All joints shall be lapped 6 inches minimum and sealed with 4” wide Vapor Bond Tape as supplied by the membrane manufacturer. Membrane shall be turned up to the top of slab, adhered to foundation walls and shall be sealed around all pipe, conduits or other penetrations. Membrane shall not be penetrated with concrete slab screed stakes. Immediately before concrete placement final inspection shall be required and any holes, misaligned seams or wrinkled seams, or other irregularities shall be patched with membrane and mastic.

The vapor barrier must have a new material permeance of less than 0.01 Perms as tested in accordance with ASTM E 1745 Section 7 and have strength in accordance with ASTM E 1745 Class A, "Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs." Thickness must be 15 mils. Tape, mastic and all other system components must be provided by the vapor barrier membrane manufacturer in order to obtain the manufacturer’s warranty.

In addition to the above, the vapor barrier shall have Permeance after ASTM E 154, Sections 8, 11, 12 and 13 mandatory conditioning tests: less than 0.01 Perms

Install vapor barrier in accordance with manufacturer’s written instructions and ASTM E 1643.

Warranty: The Contractor and Installer shall warrant the waterproofing work agreeing to repair or replace the system components which leak water, deteriorates excessively or otherwise fails to perform as required within the warranty period due to failure of materials of workmanship. By terms of warranty, also agree to remove and replace other work which has been superimposed on the waterproofing work. Warranty shall be signed by Contractor and by the Installer. Warranty shall be for a period of two years from date of substantial completion of the project.

3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

D. Proceed with waterproofing work only after substrate construction and penetrating work have been completed.

E. Installer shall examine substrate and conditions under which waterproofing work is to be performed and notify contractor in writing, of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of sheet membrane waterproofing.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Seal cracks and joints with sealant using depth to width ratio in accordance with Section 07 9005.

E. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer. Protect conditioner from rain or frost until dry.

F. Cast-In-Place Concrete Substrates
   1. Do not proceed with installation until concrete has properly cured and dried (minimum 7 days for normal structural concrete and minimum 14 days for lightweight structural concrete).
   2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
   3. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.
   4. Remove scaling to sound, unaffected concrete and repair exposed area.
   5. Grind irregular construction joints to suitable flush surface.

G. Masonry Substrates: Apply waterproofing over concrete block and brick with smooth trowel-cut mortar joints or parge coat.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing and waterproofing systems in accordance with manufacturer's written instructions.

B. Apply surface conditioner at rate recommended by manufacturer. Recoat areas not waterproofed if contaminated by dust. Mask and protect adjoining exposed finish surfaces to protect those surfaces from excessive application of surface conditioner.

C. Delay application of membrane until surface conditioner is completely dry. Dry time will vary with weather conditions.

D. Seal daily terminations with troweled bead of mastic.

E. Roll out membrane. Minimize wrinkles and bubbles.

F. Self-Adhering Membrane: Remove release paper layer. Roll out on substrate with a mechanical roller to encourage full contact bond.

G. Overlap edges and ends and seal by method recommended by manufacturer, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

H. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

I. Weather lap joints on sloped substrate in direction of drainage. Seal joints and seams.

J. Coordinate with drain installation; see Section 33 4600 – Subdrainage for additional information.

K. Install flexible flashings. Seal items penetrating through membrane with flexible flashings. Seal watertight to membrane.

L. Seal membrane and flashings to adjoining surfaces. Install counterflashing over all exposed edges.

3.04 INSTALLATION - DRAINAGE PANEL

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions. B. Adhere drainage panel to substrate with compatible adhesive.

C. Drainage panels and foundation drainage systems must include the system manufacturer's drainage piping components tied to the nearest storm drain in order for the drainage "SYSTEM" to be complete.

3.05 FIELD QUALITY CONTROL

A. On completion of horizontal membrane installation, dam installation area in preparation for flood testing.

B. Flood to minimum depth of 12 inch with clean water. After 48 hours, inspect for leaks.

C. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test. Repair damage to building. D. When area is proven watertight, drain water and remove dam.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

3.07 CLEANING AND PROTECTION

A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.

B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes penetrating water-repellent treatments for all new exterior face brick work:

1. Clay brick masonry.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each type of water repellent and substrate indicated.

C. Product certificates.

1.3 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

B. Test Area

1. Test a minimum 4 ft. by 4 ft. area on each type of masonry. Use the manufacturer's application instructions. Let test area protective treatment cure before inspection. Keep test panels available for comparison throughout the protective treatment project.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

A. Manufacturer: PROSOCO, Inc., 3741 Greenway Circle, Lawrence, KS 66046. Phone: (800) 255-4255; Fax: (785) 830-9797. E-mail: CustomerCare@prosoco.com

B. Product Description: Sure Klean® Weather Seal Siloxane PD (predilute) is a ready touse, water-based silane/siloxane water repellent for concrete and most masonry and stucco surfaces. Siloxane PD is a low-VOC treatment that penetrates more deeply than conventional water repellents and helps masonry resist cracking, spalling, staining and other damage related to water intrusion. Low odor and alkaline stable, Siloxane PD is ideal for field and in-plant application.

NOTE: Contractor is to confirm specified product with brick manufacture to ensure compatibility with the brick being treated. Any conflicts are to be brought to the architect's attention prior to ordering water repellant. If another repellant is recommended by the brick manufacturer, then that repellant, upon acceptance by the architect, shall be used at no additional cost to the owner.

C. Technical Data:

1. FORM: White milky liquid
2. SPECIFIC GRAVITY: 0.996
3. ACTIVE CONTENT: 7%
4. pH: 4-5
5. WT./GAL.: 8.29 lbs.
6. FLASH POINT: > 212 degrees F (> 100 degrees C) ASTM D 3278
7. FREEZE POINT: 32 degrees F (0 degrees C)
8. VOC CONTENT: Complies with all known national, state and district AIM VOC regulations.

D. Limitations

1. Won't keep water out of cracks, defects or open joints.
2. Not recommended for below grade application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in representative locations by method recommended by manufacturer.
2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
4. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

3.2 PREPARATION

A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.

B. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

C. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

D. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Before applying, read “Preparation” and “Safety Information” sections in the Manufacturer’s Product Data Sheet for Weather Seal Siloxane PD. Refer to the Product Data Sheet for additional information about application of Weather Seal Siloxane PD. Do not dilute or alter.

C. Vertical Application Instructions: For best results, apply protective treatment “wet-onwet” to a visibly dry and absorbent surface.

1. Spray: Saturate from the bottom up, creating a 4” to 8” (15 to 20 cm) rundown below the spray contact point. Let the first application penetrate for 5-10 minutes. Re-saturate. Less will be needed for the second application.

2. Brush or roller: Saturate uniformly. Let protective treatment penetrate for 5 to 10 minutes. Brush out heavy runs and drips that don’t penetrate.

3. Dense Surface Application Instructions:
Apply in a single, saturating application with no run down. Back roll all runs and drips to ensure uniform appearance. DO NOT OVER APPLY. One application is normally enough. Always test.

D. Horizontal Application Instructions

1. Saturate in a single application. Use enough to keep the surface wet for 2 to 3 minutes before penetration.
2. Broom out puddles until they soak in. Treated surfaces dry to touch in 1 hour. Protect surfaces from rainfall for 6 hours following treatment. Many surfaces need several days to develop full water repellency.
3. Protect from rain for 6 hours and from pedestrian and vehicular traffic until visibly dry.

3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation and vapor retarder in exterior wall and ceiling construction where shown on drawings.

B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

C. Safing insulation

D. Sound Attenuation Batt Insulation

E. Mineral-wool Board Insulation

1.02 RELATED REQUIREMENTS

A.

B. Section 04-2000 - Unit Masonry

C. Section 04-2731 - Reinforced Unit Masonry

D. Section 07-5216 – Modified Bitumen

E. Section 07-8400 – Firestopping & Smoke Seals.

F. Section 09-2116 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2009.

B. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.

C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

D. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials, 2010.

E. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2009b.

1.04 SUBMITTALS

A. See Section 01-3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Certificates for Credit MR 5: Submit product data and/or other documentation indicating location of material manufacturer for regionally manufactured materials.

a. Include statement indicating cost and distance from the manufacturer to project for each regionally manufactured material.
b. Include a statement indicating cost and distance from point of extraction, harvest, or recovery to Project for each raw material used in regionally manufactured materials. 1.05 QUALITY ASSURANCE

A. ASHRAE Fundamental Handbook shall be guide for calculating System R-values/U-values.

B. All insulation materials shall be properly identified on the package with the manufacturer's name and R-value and shall indicate the fiber material.

C. Thermal Conductivity: The thickness shown are for the thermal conductivity (fully aged Kvalues at 75 deg. F. based on ASTM C236 or ASTM C518) specified for each material. Provide adjusted thicknesses as directed for the use of material having a different thermal conductivity. Where insulation is identified by R-value, provide appropriate thickness.

D. Rigid Foam Plastic Insulation: Protect extruded plastic insulation from excessive exposure to sunlight.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.07 DELIVERY, STORAGE AND HANDLING

A. Do not allow insulation materials to become wet or soiled or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 PRODUCTS

2.01 FIBER BOARD INSULATION MATERIALS

A. For curtainwall insulation - See Section 07-8400 - Firestopping and Smoke Seals.

2.02 BATT INSULATION MATERIALS

A. Batt Insulation: ASTM C665, Type 1 (unfaced), and E136; preformed batt; friction fit, conforming to the following:
   1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
   2. Material: Glass or mineral fiber.
   3. Flame Spread Index: 25 or less, when tested in accordance with ASTM E 84.
   4. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
   5. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
   6. Formaldehyde Content: Zero.
   7. Thermal Resistance: R of 11 to R of 25.
   8. Thickness: Sized to fit stud width indicated on drawings.
   9. Facing: Unfaced.
   10. Manufacturers:
      a. CertainTeed Corporation: www.certainteed.com.
      b. Johns Manville Corporation: www.jm.com.
      c. Owens Corning Corp: www.owenscorning.com.
   11. Substitutions: See Section 01 6000 - Product Requirements.
B. Safing Insulation: ASTM C 664; high-density mineral fiber insulation to provide fire protection in penetrations and construction joints and other firestopping applications.
   1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2. Flame Spread Index: 15, when tested in accordance with ASTM E 84.
3. Smoke Developed Index: 0 when tested in accordance with ASTM E 84.
4. Combustibility: Noncombustible when tested in accordance with ASTM E 136.
5. Thermal Resistance: R = 4.2 per inch thickness.
6. Density: 4.0 lbs/cu ft 7. Unfaced.
8. Manufacturers:
   a. CertainTeed Corporation: www.certainteed.com.
   b. Johns Manville Corporation: www.jm.com.
   c. Owens Corning Corp: www.owenscorning.com.
   d. Thermafiber, Inc: www.thermafiber.com.
9. Substitutions: See Section 01-6000 - Product Requirements.

C. Sound Attenuation Batt Insulation: Unfaced creased mineral fiber acoustical insulation at walls and standard mineral fiber acoustical insulation at ceilings complying with ASTM C 665, Type I, Unfaced.
   1. Fire Hazard Classification: ASTM E84; Maximum Flame Spread Index of 0, Maximum Smoke Developed Index of 0.
   2. Combustibility: Noncombustable when tested in accordance with ASTM E 136 - passes
   3. Thermal Resistance: R of 3.7 per inch.
   4. Density: 2.5 pcf (nominal).
   5. Thickness: Provide thickness sized to fit walls per STC rating indicated on the drawings.
   6. Minimum Recycle Content : 70% (Pre-Consumer).
   7. Manufacturers:
      a. Basis of Design: ThermaFiber, Inc: Product: Sound Attenuation Fire Blanket (SAFB); www.thermafiber.com.
      b. CertainTeed Corporation: www.certainteed.com.
      c. Johns Manville Corporation: www.jm.com.
      d. Owens Corning Corp: www.owenscorning.com.
      e. Substitutions: See Section 01-6000 - Product Requirements.
   8. Manufacturers: Sound batts to be located at all interior GWB walls. Extend sound batts to deck above where walls are sealed to deck.

D. Sound Attenuation Board Insulation: Unfaced mineral fiber acoustical insulation boards mechanically fastened with impaling pins and washers to underside of metal floor deck above spaces as indicated on the drawings.

   1. Mineral-Wool Board, Types IA and IB: ASTM C 612, Types IA and IB; unfaced, with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Nominal density of 4 lb/cu. ft. (64 kg/cu. m).
   2. Product: ThermaFiber VersaBoard 40
   3. Thickness: 7”

2.03 ACCESSORIES

A. Tape: Polyethylene self-adhering type, mesh reinforced, 2 inch wide.
B. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be mechanically fastened to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

C. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 INSULATION INSTALLATION - GENERAL

A. Comply with manufacturer's installation instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult manufacturer's technical representative for specific recommendations. Submit written recommendations before proceeding with the work.

B. Extend insulation full thickness as shown over the entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation or insulation manufacturer approved sealant or tape.

C. Replace insulation which is torn, displaced, water soaked or otherwise damaged with new acceptable material.

D. Tape joints and ruptures in facing, using sealing tape. Seal each continuous area of insulation to surrounding construction so as to ensure vapor-tight insulation.

E. Do not install insulation over or within 3" of recessed lighting fixtures, ballasts, wiring compartments, fans, or other heat-generating devices unless fixtures are protected. F. Coordinate work with installation of other materials.

3.03 WASTE MANAGEMENT

A. Plan and coordinate insulation work to minimize generation of off-cuts and waste. Sequences work to maximize use of insulation off-cuts and waste.

B. Preferences shall be given to suppliers who take back waste for reuse or recycling where choices exist in provisions of mineral wool insulation.

3.04 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall and ceiling spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Coordinate work of this section with construction of air barrier seal specified in Section 07-2500.

3.05 SAFING INSULATION INSTALLATION

A. Penetrations: Safing insulation should be cut slightly larger than the opening and compression fitted into the opening, leaving no voids.

B. Construction joint application: Safing insulation should be compression fitted into the joint opening, leaving no voids.

3.06 CLEANING AND PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

B. Clean up all debris daily from project site.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closed Cell Spray Polyurethane Foam (SPF) Cavity Wall Insulation.

1.2 RELATED SECTIONS

A. Section 04 2000 - Unit Masonry assemblies: Cavity wall assemblies.

B. Section 04 2000 - Unit Masonry assemblies: Thru-wall and surface mount membrane flashing.

C. Section 04 2731 – Reinforced Unit Masonry.

D. Section 04 7200 - Masonry Mortar and Grout: Product requirements for Mortar and grout.

E. Section 05 1200 - Structural Steel Framing: Product requirements for steel anchors.

F. Section 05 5000 - Metal Fabrications: Product requirements for loose steel lintels.

G. Section 07 6200 - Sheet Metal Flashing and Trim: Requirements for flashings. H.

Section 07 8400 - Firestopping: Firestopping at penetrations of masonry work.

I. Section 07 9005 - Joint Sealers: Rod and sealant at control and expansion joints.

1.3 REFERENCES

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E 2178 Standard Test Method for Air Permeance of Building Materials.

C. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

D. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

E. ASTM E 119 – Standard Test Method for Fire Test of Building Construction and Materials

J. AATCC 127 - Water Resistance: Hydrostatic Pressure Test.

K. NFPA 285 – Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus

1.4 SUBMITTALS

A. Submit under provisions of Section 01 3300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

4. Sample of Manufacturers one- year material warranty.

C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing polyurethane foam products and systems of this section with minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years documented experience.

1. Installer must be an NCFI GoldStarSM certified insulation contractor or have manufacturer's certification for the application.

2. Installer shall provide the equipment required by the manufacturer for proper installation including high pressure plural component proportioning pump, heated hoses of suitable length, spray gun, drum pumps or other material feeding system, and other ancillary equipment required for the Work.

C. Membrane Flashing Installation prior to application of spray foam system: The spray foam contractor is to coordinate with the waterproofing contractor well in advance for the installation ALL membrane flashing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage for the chemicals should be between 65°F and 80°F for proper processing through the spray equipment. Chemicals shipped during winter or summer months may need extra time in moderate temperature storage to stabilize back in the proper application range. Cold chemicals can cause poor mixing, pump cavitation or other process problems due to higher viscosity at lower temperatures. Storing chemicals above 90°F should be avoided as much as possible. Excessively warm chemicals should be cooled prior to opening the drums. Do not store in direct sunlight. Keep drums tightly closed when not in use and under dry air or nitrogen pressure of 2-3 psi after they have been opened.

B. Store and dispose of solvent-based materials, and materials used with solvent- based materials, in accordance with requirements of local authorities having jurisdiction.

C. Mock-Up: Provide SPF application to wall mock-up specified under masonry. Provide insulation for evaluation of surface preparation techniques and application workmanship. Panel approximate size will be 15’ x 10’.

1. Finish areas designated by Architect.

2. Do not proceed with remaining work until workmanship is approved by Architect.

3. Refinish mock-up area as required to produce acceptable work.

4. Accepted mock-ups shall be comparison standard for remaining Work

1.7 PRE-INSTALLATION MEETINGS

A. Convene pre-installation meeting a minimum of two weeks prior to commencing work of this section.

B. Attendance: Architect, General Contractor, waterproofing contractor, mason/wall finish applicator and SPF applicator.

C. Agenda: Review installation sequence, safety requirements, warranty requirements, inspections and application procedures, and scheduling.

1.8 COORDINATION

A. Ensure that the installation of products of this section is coordinated with affected trades to prevent interruption of construction progress.

B. Spray foam contractor is responsible for reviewing all conditions and surfaces prior to spraying to ensure that the area is ready to spray. By spraying any area, the spray foam applicator accepts that all conditions and surfaces are ready to spray.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not install spray polyurethane foam during precipitation or when precipitation is imminent. Do not install when the ambient temperature is less than authorized by the manufacturer application guidelines or without specific authorization of the manufacturer. Do not install when the ambient humidity exceeds the manufacturer's limits.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. NCFI Polyurethanes, which is located at: 1515 Carter Street P. O. Box 1528; Mount Airy, NC 27030-1528; Toll Free Tel: 800-346-8229; Tel: 336-789-9161; Email: request info (info@ncfi.net); Web: www.ncfi.com (Basis of Specification)

B. BASF Corporation WALLTITE® spray-applied polyurethane foam insulating air barrier system

C. JM Corbond III® closed-cell spray polyurethane foam (SPF) insulating air barrier system

2.2 MATERIALS

A. Spray Polyurethane Foam (SPF) Cavity Wall Insulation: NCFI's InsulBloc closed cell spray-in-place polyurethane foam (SPF) insulation:

1. Physical Properties:

a. Core Density: 1.9 to 2.2 lbs/ft3 when tested in accordance with ASTM D 1622.

b. Water Vapor Transmission: Less than or equal to 1.0 perms at 2 inches thick when tested in accordance with ASTM E 96.

c. Compressive Strength: 20 psi minimum when tested in accordance with ASTM D 1621.

d. Flame Spread: Equal to or less than 25 when tested in accordance with ASTM E 84.

e. Smoke Developed: Equal to or less than 450 when tested in accordance with ASTM E 84.

f. Air Leakage: 0.004 CF /min/SF at 1.57 psf cfm/sf when tested in accordance with ASTM E 283 or ASTM 2178.

g. Certified as Water Resistive Barrier per - AATCC 127 and ASTM E331.

h. Potential Heat value per NFPA 259

i. Report tested and approved substrates and exterior covering materials per NFPA 285 testing

j. Report Fire Resistive Wall Assembly rating per ASTM E 119 (as required by design)

2. R-Value: R-Value when tested in accordance with ASTM C 518.

a. R-Value: 13. Thickness 2 inches (51 mm). Insulation Thickness Tolerances are – ¼" to + ½".

2.3 MISCELLANEOUS MATERIALS

A. Foam Repair Kit: Foam Repair Kit: Handi-Foam two-part kits from Fomo Products, or Touchn'Seal 2 component systems from Convenience Products, or equivalent kits.

B. Mineral Wool: Delta Safing Mineral Wool Board, 4 lb./cu. ft. density, manufactured by Rock Wool Manufacturing Co., Leeds, AL or equivalent.

C. Moisture Detection Paper (MDP) Strips: MDP Strips manufactured by NCFI Polyurethanes, Mount Airy, NC.

D. Thru-wall Membrane Flashing Materials: Textroflash by Hohmann & Barnard; 40 mil thick thru-wall flashing/surface-mounted composite membrane flashing with an adhesive backing factory-laminated to a rugged, polyethylene sheeting, yielding a flexible membrane suitable for use on masonry, concrete, steel, gypsum and wood. Apply Primer-SA Hohmann & Barnard's water-based primer for self-adhering flashing on all surfaces to receive this membrane flashing. Apply in strict accordance per the membrane manufacturer's written instructions. UV resistance is for up to 120 days. The spray foam

contractor is to coordinate with the waterproofing contractor and masonry well in advance for the installation ALL membrane flashing.

E. Other approved air barrier transition materials as approved by NCFI Polyurethanes and the architect.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Review NCFI Product Stewardship Manual for ventilation and Personal Protective Equipment requirements and ensure unauthorized workers are not in the area during the spray foam application

B. Clean surfaces thoroughly prior to installation.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

D. Proceed with spray polyurethane foam application only after substrate construction, substrate penetration work, and related welding and other hot work has been completed.

E. Verify that mortar has cured sufficiently for all masonry substrates and is dry by checking surface for moisture with Moisture Detection Paper (MDP) strips.

F. Gaps in junctions of wall materials wider than 2” shall be covered with approved transition membrane or backer fill material and liquid applied flashing membrane (Prosoco Fast Flash).

G. Fill voids between masonry and structural steel greater than 2 inches (51 mm), with mineral wool or a backer gypsum board cut to fit in the void, and then spray over the backer material.

H. On metal stud/GWB wall assemblies install transition membranes around corners at window/door openings and around wall penetration for plumbing and electrical conduit as stipulated in design details.

I. For applications to CMU, concrete or masonry base walls, use transition membranes to seal junctions of dissimilar materials, such as window framing. Do not apply transition membranes at wall corners or changes of plane where the masonry/concrete construction is continuous. Backer material covered with transition membrane can be used to bridge between two masonry/concrete walls constructed independent of each other.

J. Mask adjacent materials as needed to prevent overspray.

K. Review NCFI Product Stewardship Manual for ventilation and Personal Protective Equipment requirements and ensure unauthorized workers are not in the area during the spray foam application.

L. Cordon off area for spray foam application and post warning signs as necessary to prevent entry to the area by other persons not wearing appropriate Personal Protective Equipment (PPE).

3.3 INSTALLATION

A. Apply SPF directly to the masonry block, concrete or exterior gypsum wall board in accordance to the manufacturer's installation instructions. Multiple layers of foam may be applied as required to achieve the required thickness. Total thickness to any area must be applied on the same day.

B. All surfaces to be sprayed with SPF must be free of all forms of moisture and ice. Surfaces shall be checked with NCFI's MDP (Moisture Detection Paper) strips prior to and during foam application.

C. Do not apply SPF during inclement weather or when ambient temperature and humidity are outside the ranges prescribed by the manufacturer.

D. Apply the SPF to an average thickness indicated on the Drawings or specified in the schedule at the end of this section. Minimum thickness of SPF will be as indicated in the following table:

R-Value of Insulation	Average Thickness (inches)	Minimum Thickness (inches)
6.8	1	¾
9.6	1½	1¼
13	2	1½
16	2½	2
19	3	2½

E. Excess thickness permitted up to point it does not interfere with the installation of the veneer system. The required 1” air space between the SPF surface and the back side of the veneer must be maintained for at least 90% of the wall area. Excess thickness may be trimmed or sanded from the SPF surface. F. Remove overspray from adjacent surfaces.

G. Where damage occurs, which violates the SPF's air seal and moisture seal, repair as needed using the specified spray polyurethane material or the specified foam repair kit material.

H. If additional SPF layer is required to achieve the minimum thickness on days after the initial foam application, the area must be cleaned of any substance that may hinder proper adhesion of the new layer of foam (dust, dirt, water, etc.). High pressure air, spray water wash or physical brushing may be used as determined by the spray foam contractor to accomplish the cleaning.

3.4 PROTECTION

A. Protect installed SPF until closure or completion of wall surfaces.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 CLEANING

A. Remove excess insulation.

B. Replace defective insulation.

C. Clean soiled surfaces with cleaning solution. **END OF SECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roofing Insulation for the Modified Bitumen roofing system specified for this project.

B. Loose lay gypsum substrate (only at hourly rated assemblies); mechanically attach base layer of polyisocyanurate insulation to steel deck; adhere second layer of polyisocyanurate insulation in foam adhesive; adhere tapered insulation crickets in foam adhesive where indicated in Contract Drawings; adhere overlayment insulation in foam adhesive. Locations of rated roof and roof/ceiling assemblies are indicated on the drawings.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section, including but not limited to:

Steel Roof Deck	Section 05 3100
Rough Carpentry	Section 06 1000
Modified Bitumen Roofing	Section 07 5216

1.03 REFERENCES

A. Refer to the following references for specification compliance:

1. 2018 South Carolina Building Code
2. National Roofing Contractors Association – NRCA
3. FM Global
4. Underwriters Laboratories, Inc. – UL
5. ASHRAE Standard 90.1

1.04 DESCRIPTION

A. R Value

1. The minimum thickness for the above deck base insulation system shall be 4” minimum (LTTR Value = R25) and in accordance with the current Energy Conservation Code and ASHRAE 90.1.
2. R value to be based on Long-Term Thermal Resistance (LTTR) for polyisocyanurate insulation and manufacturer’s published data for all other insulation components, as tested in accordance with ASTM C177, C236, C518 or C976.

1.05 SUBMITTALS

A. Refer to Section 01 3300-Submittal Procedures for requirements.

B. Manufacturer’s Product Data Sheets for all materials specified certifying material complies with all specified requirements.

C. Tapered insulation plan from material supplier with minimum R-value for each roof area.

D. Latest edition of the Manufacturer's current material specifications and installation instructions.

E. Fastening shall be indicated on the roofing shop drawings by roofing manufacturer based on project requirements.

1.06 QUALITY ASSURANCE

A. Insulation to be installed in accordance with their respective manufacturer's requirements.

B. Insulation(s) not bearing UL label at point of delivery shall be rejected.

C. Insulation damaged or wetted before, during, or after installation shall be removed from the job site no later than the next working day from the day such damage or moisture contamination is noted.

D. Wind Design: Install insulation system to meet the required wind uplift pressures as specified in Sections 07 5216 and 07 5400.

E. Insulation Securement:

Steel Deck Fasteners: Screws and metal plates shall be tested and approved in compliance with Factory Mutual standard 4470 and listed in the current FM Approval Guide as such.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Material shall be delivered in the manufacturer's original sealed and labeled shrouds and in quantities to allow continuity application.

B. Storage: Materials shall be stored out of direct exposure to the elements on pallets or dunnage at least 4 inches above ground level at site location acceptable to Owner.

1. Utilize tarps that will completely cover materials to prevent moisture contamination. Remove or slit factory shrouds and/or visqueen; do not use these materials as tarps.
2. When storing on the ground, store in areas on top of a continuous vapor barrier or other means to prevent potential damage due to moisture from below.
3. Store materials on a clean flat surface.
4. Remove damaged or deteriorated materials from the job site. C. Handling:

1. Material shall be handled in such a manner to preclude damage and contamination with moisture or foreign matter.
2. Use caution when loading gypsum or any other materials to avoid damage to roof decking or to cause any deflection.

1.08 PROJECT CONDITIONS

A. Insulation shall not be applied during precipitation. Contractor assumes all responsibility for starting installation in the event there is a probability of precipitation occurring during application.

B. Contractor will take necessary action to restrict dust, and debris from entering the structure.

C. No more insulation shall be installed each day than can be covered with membrane and base flashings in the same day to create a watertight installation.

1.09 WARRANTY

A. All roof insulation products, fasteners, adhesives shall be included in the roof system manufacturer's warranty specified in Section 07 5216.

PART 2 PRODUCTS

2.01 MATERIALS

A. Insulation Boards:

1. Gypsum Substrate: Shall be nonstructural, glass mat faced gypsum panel with 500 psi moisture resistant treated core, non-asphaltic primer surfacing, and tested in accordance with ASTM E 84 and ASTM E 136. The board must be listed in the U.L. assembly being used for the rated roof construction. Board Size shall be 4' by 8' and thickness shall be 5/8", Type X. Acceptable manufacturers include:

    a. GP Gypsum DensDeck
    b. USG Securock
    c. DEXcell Glass Mat Roof Board

2. Polyisocyanurate Insulation: Shall be rigid polyisocyanurate roof insulation board with factory applied coated polymer bonded glass fiber mat facers on the top and bottom. Boards to comply with ASTM C1289 Type II, Class 2, Grade 2 and meet the following requirements:

    a. Curing time shall be 24 hours minimum, plus an additional 24 hours minimum per inch thickness, at a minimum of 60 degrees F before shipment from the manufacturer.
    b. Dimensional stability shall be 2 percent maximum linear change when conditioned at 158 degrees F and 97 percent relative humidity for seven days.
    c. Maximum permissible insulation board size for mechanical attachment is 4' x 8' and for foam adhesive and hot asphalt attachment is 4' x 4'. Field cutting of larger boards is not acceptable.
    d. Minimum two layers of polyisocyanurate, with maximum thickness of 2" per layer, to be provided with thickness as necessary to meet or exceed the specified minimum R-value.

    Acceptable manufacturers include:

        1. Atlas

2. Hunter
3. Johns Manville (JM)

3. Tapered Insulation Crickets: Shall be rigid polyisocyanurate roof insulation board meeting the above requirements for Polyisocyanurate Insulation and as follows:

   a. Board size shall be 4 foot by 4 foot.
   b. Slope shall be 1/2" per foot and minimum thickness shall be ½".
   c. Fill Insulation: Shall be rigid polyisocyanurate meeting the above requirements with board size of 4 foot by 4 foot and thickness of 2".

4. Overlayment Insulation: Shall be cover board approved by roof system manufacturer. Board Size shall be 4' by 8' and minimum thickness shall be as determined by roofing manufacturer for wind uplift requirements and project conditions. Acceptable products include:

   a. Georgia Pacific DensDeck Prime Roof Board
   b. USG Securock Glass-Mat Roof Board
   c. Soprema Sopraboard

5. Asphalt impregnated wood fiber tapered edge strips and cant strips to be the sizes detailed or required by field conditions meeting ASTM C 208.

a. Tapered Edge Strips:

   i. Shall be installed at edges to make transitions as detailed in Contract Drawings.
   ii. Use 1/2" by 6" tapered edge strips in front of tapered insulation crickets to provide smooth transition.

b. Walls and vertical terminations to receive 4" vertical leg cant strip with 5-5/8" face unless height restrictions dictate smaller sizes. B. Insulation Attachment Materials:

1. Steel Deck Mechanical Fasteners and Stress Plates: Shall be corrosion resistant 3" galvalume stress plate and corrosion resistant screw type fasteners for use with steel decks; approved by the insulation manufacturer for the insulation type, thickness and board size specified; fastener length as required by the fastener manufacturer for the insulation thickness specified, and to penetrate the deck a minimum of 3/4 inch and a maximum of 1 inch.
2. Foam Adhesive: Shall be a two part, VOC compliant, polyurethane foamable adhesive designed as roof insulation adhesive and approved by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Contractor to inspect substrate for obvious defects and notify the owner's 3rd party roofing inspector and the Architect in writing of any deficiencies. No work shall commence until

decking substrate has been inspected and accepted per written reports by the owner's 3rd party roofing inspector.

B. Commencement of work signifies General Contractor's acceptance of substrate. Any defects in roofing work resulting from such accepted substrates shall be corrected, reinspected and accepted per written reports by the owner's 3rd party roofing inspector at no additional expense.

C. Quality Control by the General Contractor and all sub-contractors is required.

3.02 PREPARATION

A. General

1. Roof deck to be dry and broomed clean of debris and foreign matter prior to installation of insulation system.

3.03 APPLICATION

A. General

1. Application shall be in accordance with the insulation/membrane manufacturer's instructions and these specifications. Insulation installation shall be in compliance with the intent of FM 1-90 uplift. Additional fasteners at perimeters and corners are required per the intent of FM I-28 publication."
2. All insulation to be in full sheets, carefully fitted and pushed against adjoining sheets to form tight joints. Gaps exceeding 1/4 inch will not be accepted.
3. Insulation and overlayment boards that must be cut to fit shall be saw cut or knife-cut in a straight line, not broken. Chalk lines shall be used to cut insulation. Uneven or broken edges are not acceptable.
4. Remove insulation dust and debris that develops during insulation cutting operations.
5. Joints between successive and adjacent layers of insulation to be offset a minimum of six (6") inches.
6. Stagger joints of gypsum overlayment/overlayment insulation one (1') foot (vertically and laterally) to ensure that joints do not coincide with joints from the previous or adjacent layer.
7. On steel decks, apply insulation boards with long dimension of units across deck ribs. Ends of insulation boards must be bearing on top flange of steel deck.
8. Crickets, saddles and tapered edge strips shall be installed before the overlayment insulation.
9. Adhere cant strips and tapered edge strips at transitions, terminations and/or penetrations as detailed or required in ribbons of foam adhesive to ensure smooth transitions are provided for the roof membrane and flashings.
10. Provide necessary modifications to insulation system or nailers at roof edges as required to ensure a flush and smooth transition is provided for the roof membrane and flashing.

11. Field modifications of insulation, tapered insulation, tapered edge strips and cants shall be made by the Contractor where required to accommodate roof and flashing conditions, prevent water dams and ponding water. Ponding water at scuppers and cricket valleys shall not be accepted.
12. Provide necessary modifications to prevent standing water which is defined as 1/4" of water in a 4 square foot or larger area 24 hours or more after precipitation.
13. Coordinate decking conditions with General Contractor Do not accept substrates if deflection exist in the substrates.

B. Tapered Insulation

1. Install tapered insulation system to provide positive slope for complete roof drainage.
2. Crickets shall be sized as shown in the Contract Drawings. Modifications shall be provided to ensure positive slope and prevent standing water along the cricket valley.

    a. Minimum length to width ratio shall be 2:1. Fabricate partial crickets with dimensions which would result in a minimum length to width ratio of 2:1 if they were extended to full size.
    b. Unless otherwise noted, fabricate all crickets from tapered stock as required to provide the specified minimum slope. For example, when roof slope is indicated as 1/4" per foot minimum, fabricate crickets with slope of 1/2" per foot minimum.
    c. Construct crickets on up slope side of all curbs to ensure positive drainage.
    d. Install tapered edge strips at cricket edges to provide a smooth transition between the cricket and insulation system below.

3. Insulation boards may require mechanical fasteners and stress plates at slope transition of crickets to minimize bridging. C. Roof Drainage:

1. Drainage sumps shall be installed as detailed.
2. The Contractor shall be responsible for carefully laying out the tapered insulation, sumps, drain bowls and scuppers to ensure the finished roof provides complete drainage with no standing water.
3. Contractor shall fabricate miter-cut sumps at scuppers to provide smooth transitions between the insulation system and the drains/scuppers.
4. Sumps shall ensure complete roof drainage and prevent water dams.
5. Contractor shall adjust insulation, drains and scuppers to ensure complete roof drainage and satisfactory substrates for membrane and flashings.
6. Drain sump components shall be fastened to the deck using specified insulation fasteners or adhesives.
7. Circular sumps and sumps that do not provide smooth transition or that create standing water at the drains shall be rejected and shall require removal and replacement.

D. Insulation Mechanical Attachment

1. Fastener quantity and spacing shall be as determined by the roofing manufacturer based on project requirements.

2. Fasteners shall be installed using manufacturer's recommended equipment and in accordance with the manufacturer's requirements.
3. Fasteners and stress plates shall be set secure and tight against the insulation surface, and shall not be over-driven.
4. Fasteners shall engage the top flange of steel decks only.
5. Note: The membrane system is to be isolated from any mechanical attachments."

E. Foam Adhesive Application

1. Comply with the requirements of the membrane manufacturer's tested assembly for adhesive spacing and positioning.
2. Adhesive beads shall be sized in accordance with the adhesive manufacturer's guidelines.
3. Insulation boards shall be placed onto the beads and immediately "walked" and/or "weighted" into place. Insulation boards must be placed into the adhesive in strict accordance with the adhesive manufacturer's guidelines.
4. Ensure full adhesion of all layers of insulation and take whatever steps necessary to achieve full adhesion, including but not limited to temporary ballasting of insulation until adhesive sets.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of liquid applied vapor permeable, self-sealing air barrier.

C. Materials for:
1. All penetrations through the wall assembly.
2. Connections to foundation walls.
3. Walls, windows, curtain walls, storefronts, louvers or doors.
4. Expansion and control joints.
5. Masonry ties.
6. Wall and roof connections and penetrations.
7. Membrane flashings at all wall and roof connections and penetrations, wall flashing, through-wall flashing, door and window openings and all horizontal sills, headers and any other horizontal conditions indicated.

1.02 RELATED SECTIONS

A. Section 04 2000 - Unit Masonry.

B. Section 07 2100 - Thermal Insulation.

C. Section 07 4243 - Composite Wall Panels (Type 1)

D. Section 07 5216 - Membrane Roofing Modified Bitumen Roofing.

E. Section 07 5400 - Thermoplastic Single-Ply Roofing.

F. Section 07 6200 - Flashing and Sheet Metal.

G. Section 07 8400 - Firestopping & Smoke Seals.

H. Section 07 9005 - Joint Sealants.

I. Section 08 1113 - Hollow Metal Doors Frames

J. Section 08 4110 - Aluminum-Framed Entrances and Storefronts

K. Section 08 4413 - Glazed Aluminum Curtain Walls

L. Section 09 2160 - Gypsum Board Assemblies

M. Section 09 2200 - Fiber Reinforced Stucco

1.03 REFERENCES

A. ASTM D 412 (06a) – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

B. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection – Section 7.9 Nail Sealability

C. ASTM D 4541 - Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.

D. ASTM E 96 – Standard Test Method for Water Vapor Transmission of Materials.

E. ASTM E 2178 (01) – Standard Test Method for Air Permeance of Building Materials.

F. ASTM E 2357 (05) – Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

G. ICC ES-AC 212 - Acceptance Criteria for Water-Resistive Coatings used as Water-Resistive Barriers on Exterior Sheathing

H. NFPA 285 – Standard Test Method of determining the flammability characteristics of exterior, non-load bearing wall assemblies/panels.

1.04 SUBMITTALS

A. Comply with Section 01 3300 - Submittal Procedures.

B. Submit manufacturer's product data, application instructions and shop drawing details specific to this project.

C. Sustainable Design Submittals:

1. Submit invoices and documentation from manufacturer of the amounts of materials and content for products specified.

2. Submit invoices and documentation showing manufacturing locations and origins of materials for products manufactured and sourced within 500 miles of project site. D. Sustainable Design Submittals:

1. Product Data: For coatings, indicating VOC content
.
2. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Fluid-applied membrane must be manufactured by a company with a minimum of ten (10) years of experience in the production and sales of membrane materials.

B. Applicator Qualifications: An established waterproofing firm and along with the actual applicators having at least three (3) years of experience in applying these types of specified materials and specifically accepted in writing by the membrane system manufacturer.

C. Materials: For each type of material required to complete the work of this section, provide primary materials which are the products of a single manufacturer.

D. Substrate: The waterproofing contractor and applicator is fully responsible for inspecting all substrate surfaces prior to the application of this membrane. Application of this product indicates that the substrates have been inspected. Waterproofing contractor will be responsible for correcting any substrate surface not properly prepared to receive the air barrier membrane where the barrier membrane has been installed.

E. Pre-Application Conference: A pre-application conference shall be held at least one week prior to application to establish procedures and to review conditions, installation procedures and coordination with other related work. Meeting agenda shall include review of special details and flashing.

F. Manufacturer's Representative: Arrange to have trained representative of the manufacturer on-site periodically to review installation procedures.

G. The architect reserves the right to require inspections by the Air/Moisture Barrier manufacturer at contractor's expense if continued, improper application methods exists. The contractor will also be fully responsible for any project schedule changes related to such manufacturer's inspections and any required corrective work.

1.06 MOCK-UPS

A. Prior to installation of air barrier, apply air barrier as mock-up example to verify details under shop drawing submittals and to demonstrate tie-ins with adjoining construction, and other termination conditions, as well as qualities of materials and execution.

B. Construct typical exterior wall panel, 6 feet long by 6 feet wide, incorporating back-up wall, cladding, window and door frame and sill, insulation, flashing; illustrating materials interface and seals. Mock-up must include one of each condition on the project. Provide multiple mock-up panels if required or as directed by architect to show all flashing conditions.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area and on a stable surface with the lid securely closed in accordance with manufacturer's instructions and local governing regulations.

C. Store at temperatures at or above 40°F (4°C), free from contact with cold or frozen surfaces. For best application results, store in ambient temperatures above 50°F (11°C).

D. Protect materials during handling and application to prevent damage or contamination.

1.08 PROJECT CONDITIONS

A. Proceed with installation only when substrate construction and preparation work is complete.

B. Warn personnel against breathing of vapors and contact with skin and eyes; also wear appropriate protective clothing and respiratory equipment.

C. Maintain work area in a neat and workmanlike condition. Remove empty cartons and rubbish from the site daily.

1.09 WARRANTY

A. Manufacturer warrants only that this product is free of defects, since many factors which affect the results obtained from this product are beyond our control; such as weather, workmanship, equipment utilized, and prior condition of the substrate. We will replace, at no charge, proven defective product within twelve (12) months of purchase, provided it has been applied in accordance with our written directions for uses we recommended as suitable for this product. Proof of purchase must be provided.

B. In addition, the contractor is to provide a Five (5) year Material and System Warranty. All
work is to be in strict compliance with the manufacturer's written instructions and warranty requirements along with periodic inspections by the manufacturer's trained representative.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Polyguard Products Inc. P.O. Box 755 Ennis, TX 75120-0755; Phone: (214) 515-5000 Fax: (972) 875-9425 Email: info@polyguardproducts.com

2.02 MATERIALS

A. VOC Emissions: Products shall contain no more than half of the chronic REL of VOCs when tested according to the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

B. Basis of Design: Polyguard® Airlok Flex® WG (Weather Guard) is a fluid-applied, acrylicbased, vapor permeable membrane.

1. Performance-based Specification: Air barrier membrane shall be acrylic based, that cures to form a tough, continuous, bonded elastomeric membrane having the following characteristics:

PHYSICAL PROPERTIES

PROPERTY	**TEST METHOD**	**TYPICAL VALUE**
COLOR		Gray
AIR PERMEANCE	ASTM E 2178-01	0.0009 cfm/ft²
AIR LEAKAGE & DURABILITY	ASTM E 2357-05	0.0002 cfm/ft²
WATER VAPOR PERMEANCE	ASTM E 96	19 perms
CRACK BRIDGING	ICC AC 212	Pass
ULTRAVIOLET (UV) EXPOSURE LIMIT (120 DAYS MAX ALLOWED)	BY MANUFACTURER	Up to 2 years
ALLOWED)PULL ADHESION	ASTM D 4541	100 PSI
TENSILE STRENGTH	ASTM D 412-06a Modified	168 PSI
ELONGATION	ASTM D 412-06a Modified	528%
NAIL SEALABILITY	ASTM D 1970	Pass
EVALUATION OF FIRE PROPOGATION CHARACTERISTICS	NFPA 285	Pass
VOLATILE ORGANIC COMPOUNDS (VOC)		42 g/l

C. Other acceptable manufacturers with equal products and systems subject to architect's approval prior to bidding are as follows:
1. Carlisle
2. W.R. Meadows
3. BASF

2.03 ACCESSORIES

A. Flashing: Polyguard® 400 Flashing is modified asphalt bonded to a polyethylene sheet used for wall flashing, through-wall flashing (TWF), joint flashing, and air barrier. The asphalt is

protected with a release paper that is slit 3-inches in from an edge establishing two sections of release paper that can be removed independently.

1. Thickness: 40 mils
2. Puncture Resistance of Film: (ASTM D 781) 110 Kg/CM
3. Puncture Resistance Composite Membrane: (ASTM E 154) LBS 40 Min.
4. Tensile Strength Composite Membrane: (ASTM D 412 Modified Die C) PSI 750 Min.
5. Elongation of Rubberized Asphalt: (ASTM D 412 Modified Die C) 400% Min.
6. Water Vapor Transmission (Permeance): (ASTM E 96 Method B) (Grains/Sq. Ft./Hr. in HG) 0.1 Perms
7. Water Absorption: (ASTM D 570) 0.1%
8. Additional flashings are shown on the drawings and include, but are not limited to, all door and window openings and all horizontal sill, header and any other horizontal conditions. Top of 40 mil membrane flashing shall be sealed continuously with the with the manufacturer's recommended sealant. This shall be anchored to the substrate with stainless steel termination bars anchored at 4" oc. Applicator is to confirm with general contractor that proper blocking has been installed in framed wall systems prior to installing termination bars. Do not install termination bars if proper support is not provided.
9. Other conditions as indicated on the drawings using 40 mil membrane flashing.
10. CMU Control Joints: The waterproofing contractor will install a 12" vertical strip of continuous 40 mil flash placed on the cavity side of the interior wall and turned out blow floor level. The membrane is to be sealed continuously to the fluid-applied air barrier membrane.

B. Detail Sealant: Polyguard® Detail Sealant PW™ is a low VOC/HAPS free, cold-applied, self-adhesive, elastomeric sealant for filling minor cast concrete cracks, concrete masonry cracks, gaps at head joints, penetrations, and gypsum sheathing joints.

1. Application: Polyguard® Detail Sealant PW™ is dispensed from a 20-oz sausage, or a 3-gallon pail for broad knife detail work.
   a. Compatible with Polyguard Air Barrier System
   b. Air permeability system: (ASTM E 2178) 0.0007 CFM/ft²
   c. Elongation: (ASTM D 412) 275%
   d. Low Temperature Pliability: -75º F
   e. Ultraviolet radiation (UV) Rating: (ASTM G 26) 2000 hours no change

C. Primer:

1. Polyguard® Airlok Flex® WG serves as primer for the Polyguard® 400 Flashing. No other primer is necessary.

PART 3 EXECUTION

3.01 EXAMINATION

A. All surfaces to be treated must be sound, dry, clean and free of dirt, excess mortar, or other contaminants. Masonry substrate shall have tooled mortar joints.

B. Verify masonry joints are completely filled, tooled and without voids prior to commencing work.

C. Verify that excess mortar droppings have been cleaned off brick ties and masonry prior to commencing work.

D. Cutouts and breakouts for support columns and beams are to be filled and made flush with the substrate by others prior to commencing work.

E. Masonry and new concrete shall have been cured a minimum of three (3) days and must be dry at time of application.

F. Verify that substrate and conditions are acceptable to commence work within this section. Examine surfaces to receive membrane. Waterproofing contractor is responsible for notifying the General Contractor if surfaces are not acceptable.

Corrections and cleaning of masonry surfaces by the masonry contractor are to be completed and accepted by the waterproofing contractor. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Surface must be clean and dry: free of mortar or gypsum smears, ice, frost or excess moisture.

B. Knock off form ties on both sides of a concrete wall and fill flush with cement or Polyguard® Detail Sealant PW™. Allow Detail Sealant PW™ a minimum 1 hour to dry. C.

Leave CMU wall unparged.

D. Fill minor voids with a 30-mil coating of Polyguard® Detail Sealant PW™. Allow Detail Sealant PW™ a minimum 1 hour to dry.

E. Fill voids in exterior gypsum sheathing to flush with the substrate with Polyguard® Detail Sealant PW™. Allow Detail Sealant PW™ a minimum 1 hour to dry.

F. Open joints are to be filled with foam or a tooled 30-mil coating of Polyguard® Detail Sealant PW™. Allow Detail Sealant PW™ a minimum 1 hour to dry. Tight joints can be coated without additional preparation.

3.03 APPLICATION OF AIR BARRIER SYSTEM

A. Install materials following manufacturer's guide specifications.

B. Apply Polyguard® or 400 Flashing membrane after the fluid-applied application of Polyguard® Airlok Flex® WG to substrate.

C. Apply Polyguard® Airlok Flex® WG evenly to substrate using brush, roller, or airless spray equipment; checking immediately for application thickness (16 to 20 mils wet). Provide in thickness for substrates shown on this project per manufacturer's written instructions.

D. Apply Polyguard® Airlok Flex® WG over rough openings.

E. Apply extra material at anchor ties and penetrations.

F. Allow application to dry for twenty-four (24) hours, maintaining a minimum temperature of 40° F (4ºC). Inspect for continuous coverage. If necessary, apply additional material as needed to provide a continuous coating.

G. Fill control and transition joints with Polyguard® Detail Sealant PW™. Apply Polyguard® or 400 Flashing strips to window and door openings. Overlap end and side laps 2 inches. Roll all flashing to ensure seal. Seal top edge of flashing strips with a 10-mil coating of Polyguard® Detail Sealant PW™. Trowel to feathered edge.

H. Alternate: Transition and control joints can be filled prior to coating with Polyguard® Detail Sealant PW™, made flush with substrate, allowed a minimum one (1) hour to dry, then

apply a full coat of Polyguard® Airlok Flex® WG as a continuous membrane across the joint.

I. Measure application thickness with wet mil gauge. Check fresh application immediately. Provide written documentation including photographs along with manufacturer's written inspection reports. This documentation shall be provided to the general contractor, construction manager and architect.

3.04 PROTECTION

A. For twenty-four (24) hours after installation, protect completed membrane system against water filling block cores. Protect finished air barrier system from adjacent work.

B. Exposure: If the applied products are not covered by the masonry contractor or any other veneer or rain screen contractor on the project within a period of one hundred and twenty (120) days of application, the products shall be removed and reapplied in strict accordance with the manufacturer's written instructions at no additional cost to the owner. Such areas must also be re-inspected by the manufacturer's trained representative at no additional cost to the owner.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Soffits and Fascia.

B. Fastening system.

C. Exposed flashing, trim, and closures.

D. Factory finishing.

E. Fasteners, framing supports and sealants.

F. Accessories and miscellaneous components.

1.02 DEFINITIONS

A. Manufacturer: For the purposes of this section, the roofing contractor that provides on-site roll forming or uses portable roll forming equipment off site, shall NOT be recognized as the manufacturer.

1.03 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Roof framing and purlins.

B. Section 06 1000 - Rough Carpentry: Roof sheathing.

C. Section 07 2213 - Roof Board Insulation for Metal Roofing.

D. Section 07 5216 - Modified Bitumen Roof System.

E. Section 07 6200 - Sheet Metal Flashing and Trim: Exposed flashing and trim supplied and installed by metal roofing contractor.

F. Section 07 7200 - Roof Accessories: Other items supplied, installed or coordinated by metal roofing contractor.

G. Section 07 90 05 - Joint Sealers: Field-installed sealants.

1.04 REFERENCE STANDARDS

A. ANSI/SPRI ES-1 - American National Standard for Edge Systems Used with Low Slope Roof Systems.

B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; current edition.

C. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc AlloyCoated by the Hot-Dip Process; 2009a.

D. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

E. ASTM E108 -Standard Test Methods for Fire Tests of Roof Coverings; 2010.

F. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005.

G. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2003).

H. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems; 1995 (Reapproved 2003).

I. ICC - 201 International Building Code.8

J. "Cold Formed Steel Design Manual", American Iron and Steel Institute.

K. "Low Rise Metal Building Systems Manual", American Iron and Steel Institute.

L. "Manual of Steel Construction", American Institute of Steel Construction.

M. MBMA "Metal Roofing Systems Design Manual", Metal Building Manufacturers Association.

N. NRCA Roofing and Waterproofing Manual, National Roofing Contractors Association.

O. SMACNA: "Architectural Sheet Metal Manual", Sheet Metal and Air Conditioning Contractors National Association, Inc.

P. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures. In addition, submittals shall be submitted 10 days prior to bid date, and have published addenda, indicating acceptance by the architect.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Descriptive data on all materials to be included in roofing system, including sealants.
   2. Summary of test results, indicating compliance with specified requirements.
   3. Storage and handling requirements and recommendations.
   4. Installation methods, showing all requirements for panel installation, sealant application and sub-structural requirements.
   5. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.
   2. Include structural analysis signed and sealed by qualified structural engineer, licensed in the State of South Carolina and employed by the manufacturer, indicating conformance of roofing system to specified loading conditions and local codes and ordinances per ASCE07 standards, including clip spacing and attachment requirements.
   3. Submit calculations demonstrating holding strength of fasteners, through the nail board product and fastening to the wood deck below, in accordance with submitted test data, provided by fastener manufacturer, based on length of embedment and properties of materials. Fasteners are to be engineered so that they do not penetrate the exposed interior surface of the wood roof deck.

D. Manufacturer's Certification: Manufacturer shall submit certificate and supporting documentation to demonstrate that manufacturer meets qualifications listed in "Quality Assurance" paragraph, that products meet specified requirements, and manufacturer will provide warranty as required herein.

E. Installer's Certification: Submit documentation showing that installer meets the qualification requirements specified herein.

F. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

G. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.

H. Test Reports: Indicate compliance of preformed metal roofing system to specified requirements, including performance requirements specified in paragraph 2.02. I. Manufacturer's inspection reports.

J. Sample Warranty: Submit copy of sample warranty of roof system with shop drawings.

K. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Company specializing in the manufacture of standing seam metal roofing systems similar to those required for this project, with not less than ten (10) years of documented experience regardless of name change. Submit a list of similar projects with the shop drawings.
2. Roof system shall be supplied by a single source manufacturer.
3. Roofing contractor must submit, a letter from the manufacturer of the standing seam metal roof system, certifying the date of authorization to install, from the manufacturer. This requirement must be in place prior to bidding.
4. The manufacturer maintains a regularly scheduled CERTIFIED Training Program for its installers and maintains an up-to-date authorized roofing contractor list.
5. The manufacturer has a written warranty covering durability, color and weather tightness of its roof system. Sample warranties shall be provided.
6. Manufacturer shall provide fixed equipment, operated by manufacturer employee and not a portable on-site former. All standing seam panels shall be run on fixed equipment utilizing tension stabilization. Liability of finished product shall fall to single source manufacturer. Manufacturer shall be capable of producing panel lengths required for project.
    a. Portable roll forming may be used only for radius materials.
    b. Use of any forming equipment that may void the finish, structural, or roof system warranties is prohibited.
7. Manufacturer shall be identified as a provider of standing seam metal products, have sales in excess of 25 million dollars annually and provide proof of financial strengths against warranty liabilities.
8. All roofing metal must be domestic mill certified being a 50,000 tensil strength material.
9. Manufacturer shall maintain a dedicated staff of engineers, estimators and designers. Engineers and estimators are identified as roofing specialists, providing design, engineering services as full time employees of the manufacturer.
10. The manufacturer's technical staff shall schedule jobsite inspections at 25%, 50%, 75%, a final inspection and subsequent warranty inspections as required to confirm roof fully meets warranty requirements.
    a. The manufacturer's technical staff shall inspect products on the job site.

b. The manufacturer's technical staff shall inspect roof substrate for defects and inconsistencies and any condition that does not meet manufacturer's warranty requirements.

c. The architect must be present at these inspections. Notify the architect ten (10) days prior to inspection dates.

d. Submit inspection reports to Architect and photographs as required to document installation. Include any deficiencies in report and status of correction work.

I. Installer Qualifications: Company trained and authorized by roofing system manufacturer.

1. The individual(s) certified by the manufacturer for installation shall be on site at all times supervising the installation of the roof system.

a. a. Installer must submit a letter from the roofing manufacturer certifying the date that the installer was certified by the manufacturer. This date must be prior to bidding the project.

2. Installer shall maintain a minimum of $1,000,000 general liability coverage for each loss.

3. Installer shall maintain Workman's Compensation Coverage as mandated by law.

4. Installer shall have no viable claims pending, regarding negligent acts, defective workmanship on previously performed or current projects.

5. Installer shall have not filed for protection from creditors under any state or federal insolvency or debtor relief statues or codes.

6. Installer shall be identified as "primary source of business" for standing seam metal roof systems.

7. Installer shall have a minimum of 10 years documented experience in the installation of metal roofing systems similar to those required for this project.

8. Installer shall have installed five (5) projects of similar scope and magnitude that have been in service for minimum of 2 years with satisfactory performance of the entire roof system.

9. Installer must execute 100% of roof system installation, utilizing employees that are confirmed as full time employees of the contractor. Second and third tier subcontractors for the installation of work in this section shall not be permitted.

J. The Owner shall employ a third party inspector to verify that roof materials and installation meet specifications, roofing practices and other requirements associated with the roof warranty.
Copies of this report shall be distributed to the manufacturer, installer and architect.
Reinspection(s) by the third party inspector shall be required if needed at no additional cost to the owner. The third party inspector shall be:

1.07 PREINSTALLATION MEETING

A. Convene one week before starting work of this section. Manufacturer's representative and installer shall attend meeting.

B. Review preparation and installation procedures and coordinating and scheduling required with related work.

C. Meeting shall cover details associated with clips and fasteners; rolling seams; installing valleys, hips peaks; roof penetrations; flashing and counter flashings; gutters and other products or materials required to meet the warranty requirements associated with this roofing system. Meeting shall also cover critical work sequencing, coordination issues, project scheduling and manufacturer's inspection requirements.

1. The manufacturer's representative shall approve products on the job site and shall inspect the roof substrate for defects or inconsistencies prior to commencement of roof work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

C. Handling: Exercise extreme care in unloading, storing and erecting metal roof system to prevent bending, warping, twisting and surface damage.

1.09 WARRANTY

A. See Section 01-7839 - Project Record Documents for additional warranty requirements.

B. Finish Warranty: Provide manufacturer’s special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, flaking, chalking, cracking, blistering or peeling within specified warranty period of 20 year period from date of Substantial Completion.

C. Excessive color change and chalking shall be warranted for twenty (20) years. Color change shall not exceed 5 NBS units per ASTM D2244.68T, chalking shall not be less than a rating of 6 (white) or 8 (other colors) per ASTM D-659.

D. Panel Warranty: Provide warranty against defects in metal panels due to rupture, structural failure, or perforation for a period of 20 years.

E. Weather tightness Warranty: Provide manufacturer’s no-dollar-limit warranty for weather tightness of roofing system (including roofing panels, flashing, trim, and related items used to fasten the roof panels and flashing to the roof structure), including agreement to repair or replace roofing that fails to keep water from entering the building envelope within specified warranty period of 20 years from date of Substantial Completion.

F. Installer's Warranty: The Roofing Installer shall have the sole and exclusive obligation for all warranty work commencing on the date of substantial completion up to and until the roof system has performed leak free for (24) consecutive months. The sole and exclusive obligation for all warranty work commencing on the date the roof has been leak free for (24) consecutive months and under all circumstances terminates on the 20th anniversary of the date certified as Substantial Completion of the roofing manufacturer's roof system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

B. Soffit and Facia design is based on Artisan Series as manufactured by MBCI: www.mbci.com.

C. Acceptable manufacturers are:
1. McElroy Manufacturing, Inc.: www.mcelroy.com
2. Merchant and Evans, Inc.: www.ziprib.com.
3. Morin Corporation: www.morincorp.com.

D. Substitutions: See Section 01 6000 - Product Requirements.

E. Acceptable installers are:

1. Ace Construction
2. Achepole Roofing and Sheet Metal
3. Henson Roofing
4. I&E Specialties, Inc.
5. John Connor Construction
6. Lloyd Roofing
7. Pickens Roofing and Sheet Metal
8. Spann Roofing and Sheet Metal
9. Watts & Associates Roofing
10. Aqua Seal Manufacturing & Roofing, Inc.

F. Installers shall submit certification that demonstrate that they meet all the requirements of this section, including, but not limited, to current training and authorization by the manufacturer to install specified roofing system and other qualification criteria.

2.02 SOFFIT & FASCIA PANELS

A. Soffit and Fascia Panels: 22 gauge Galvalume steel solid panels with where required with 12" coverage utilizing male/female-interlocking connection. Panels shall have smooth texture. Fasteners shall be concealed and approved by the manufacturer for use in the metal types. Finish shall be 70% flouropolymer, Kynar 500®. Color and trims shall be as selected by the Architect. Isolate dissimilar metals. (Color and Profile to match existing soffit and fascia panels)

2.03 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.
   1. Provide 2 piece floating clip, 18 gauge galvanized steel base, minimum, and 24 gauge aluminum coated steel top, minimum with factory applied mastic to meet design loads.
   2. Panel clip fasteners shall be cadmium plated carbon steel, self drilling screws, size as recommended by manufacturer, with low-profile head to avoid denting the roof panels.

B. Fasteners for trim and accessories shall be as recommended by the manufacturer to withstand specified loads, non-corroding long-life type, shall not void manufacturer's finish warranty, color matched to roofing materials and equipped with appropriate sealant separators where exposed fasteners are necessary.
   1. Self-tapping screws shall be #12 x 1 ¼ or as recommended by manufacturer.
   2. Self-drilling screws shall be #12 x 1 ¼ or as recommended by manufacturer.

2.04 PANEL FINISH

A. Fluoropolymer Coating System: Manufacturer’s standard multi-coat thermocured coating system, including minimum 70 percent fluoropolymer color topcoat with minimum total dry film thickness of 0.9 mil; color and gloss as selected from manufacturer’s standards, minimum of 17 colors. Gloss shall be satin finish to minimize appearance of oil canning.

B. The interior color finish shall consist of a backer coat with a dry film thickness of 0.5 mil.

2.05 ACCESSORIES AND MISCELLANEOUS ITEMS

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish. Exposed metal shall be same material and finish as metal roof panels. C. Gutters and Downspouts: Material and finish to match roof panels, 24 gauge.

D. Sealants: As specified in Section 07 9005.
1. Sealing compounds shall be provided as recommended by panel manufacturer.
2. Exposed sealant must cure to rubber-like consistency. Provide one-part elastomeric polyurethane sealant approved by the metal roofing manufacturer.
3. Concealed sealant must be non-hardening type. Provide factory-installed sealant at juncture of male and female interlocking ribs.
4. Seam sealant must be factory-applied, non-skinning, non-drying type.
5. Tape seal is to be a pressure sensitive, 100 percent solids, polyisobutylene compound sealing tape with a release paper backing. Tape shall be permanently elastic, non-sagging, non-toxic, non-staining tape seal as recommended by the roofing manufacturer.

E. Thermal Insulation: Provide flexible blanket, rigid, or semi-rigid type, faced with white, flexible, non-dusting vapor retarder tested for maximum flame-spread rating of 50, per ASTM E 84; for installation using spacer blocks.
1. Thickness: As indicated.

F. Underlayment: ASTM D 4869 roofing felt, 30 lb., perforated type; covered by water-resistant rosin-sized building paper.

G. Ice and Water Shield: Provide self-adhered ice and water shield by Grace Construction Products in the following locations:
1. Eaves: Apply 36" wide strip back from edge of eave.
2. Install 30 lb. felt over top of all ice and water shield membranes. Do not leave exposed to sunlight.

2.06 FABRICATION

A. Panels: Fabricate panels and accessory items at factory, using manufacturer's standard processes as required to achieve specified appearance and performance requirements. B. Trim and accessories: Shall be same material and finish as panels.

C. Joints: Factory-install captive gaskets, sealants, or separator strips at panel joints to provide weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. Verify that other trades have completed work that penetrates roof prior to commencing the work of this section.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding. Commencement of work of this section shall indicate acceptance of substrate.

3.02 PREPARATION

A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

B. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

D. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Workmanship shall be of highest quality and in conformance with NRCA Roofing and Waterproofing Manual and good practices of the trade.
   2. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.
   3. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   4. Provide fastenings, cleats, and other required accessories for a complete installation as required. Fasteners shall be of lengths as required to penetrate the 3" insulation board and anchor into the wood deck.
   5. Secure units to supports as required by reviewed shop drawings. Place fasteners as required by engineer's calculations to meet design loads.
   6. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.
   7. Install panels without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.
   8. Install metal panels, fasteners, trim and related accessories in accordance with reviewed shop drawings and as may be required for a weather-tight installation.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Roof Panels: Install panels in strict accordance with manufacturer’s instructions, minimizing transverse joints except at junction with penetrations.
   1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by the panel manufacturer.
   2. Panels shall be installed in a manner that horizontal lines are true and level and vertical lines are plumb and straight.

D. Soffit Panels: Install panels in strict accordance with manufacturer’s instructions.
   1. Panels shall be installed true and level, fitted neatly to adjacent construction.
   2. Where feasible, panels shall be installed spanning 3 spans, minimizing end joints.

E. Insulation: Install insulation between roof covering and supporting members to present a neat appearance. See Section 07 2213 - Roof Board Insulation for Metal Roofing. Fold, staple, and tape seams unless otherwise approved by Architect.

3.04 CLEANING

A. Sweep roof surfaces clean daily. Clean up debris and dispose as required by local authorities.

B. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish. C. All materials at ground level shall be policed and placed in the proper containment.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Do not allow panels to come in contact with dissimilar metals such as copper, lead or graphite. No pencil marks shall be permitted on panels. Water run-off from these materials is also prohibited, including condensate from HVAC units.

C. No pressure treated wood shall be in contact with the work of this section.

D. Water shall be prevented from entering the building during the work. This shall involve keeping penetrations sealed, planning the work to re-roof sections and sealing new to old or other precautionary and effective safeguards.

E. Touch-up, repair, or replace damaged roof panels or accessories before date of Substantial Completion as determined by Architect.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes metal composite material wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
8. Review procedures for repair of panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory. B. Shop Drawings:

1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
3. Delegated Design: Provide shop drawings signed and sealed by a structural engineer licensed to practice in the location of the project, indicating ability of system and attachment to supporting construction to resist indicated or code required loads.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Composite Material Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Fabricator/Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal composite material panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that has minimum seven years of experience in fabrication and installation of projects of this type.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical metal composite material panel assembly as shown on Drawings, including corner, supports, attachments, and accessories.

2. Water-Spray Test: Conduct water-spray test of mockup of metal composite material panel assembly, testing for water penetration according to AAMA 501.2.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing. 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.

B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal composite material panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal composite material panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 330:
1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency. F. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.

2.2 METAL COMPOSITE MATERIAL WALL PANELS

A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following: a. Alcoa Architectural Products (USA).
b. ALPOLIC Materials; Mitsubishi Plastics Composites America.
c. ALUCOBOND; 3A Composites USA, Inc.
2. Basis-of-Design Product: Alucobond; 3A Composites fabricated by ECS Charlotte NC

B. Aluminum-Faced Composite Wall Panels: Formed with 0.020-inch- (0.50-mm-) thick, coil-coated aluminum sheet facings.
1. Panel Thickness: 0.157 inch (4 mm).
2. Core: Fire-retardant.
3. Exterior Finish: Three-coat fluoropolymer.

C. Attachment Assembly Components: Formed from extruded aluminum.

D. Attachment Assembly: Manufacturer's standard.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

2.4 FABRICATION

A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured. 2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast. C. Aluminum Panels and Accessories:

1. Metallic Fluoropolymer: AAMA 2605. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.

1. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation. C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal composite material panel manufacturer's written recommendations.

3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal composite material panels.

2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with selftapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.

3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as metal composite material panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels. B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.

D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.

1. Wet Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Section 079200 "Joint Sealants."

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform field tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.

D. Metal composite material wall panels will be considered defective if they do not pass test and inspections.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements. F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.

B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. TPO Mechanically fastened membrane roofing system.

B. Cover board.

C. Roof insulation.

D. Vapor retarder.

E. Substrate board.

1.2 REFERENCES

A. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms in this Section:

1. ASTM D 1079 “Terminology Relating to Roofing and Waterproofing.”
2. Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual."
3. Roof Consultants Institute “Glossary of Roofing Terms.”

B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

1.3 DESIGN CRITERIA

A. General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7.

1. Field-of-Roof Uplift Pressure: As per manufacturer’s recommendations for this specific site.
2. Perimeter Uplift Pressure: As per manufacturer’s recommendations for this specific site.
3. Corner Uplift Pressure: As per manufacturer’s recommendations for this specific site.

D. FMG Listing: Roofing membrane, base flashings, and component materials shall comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's “RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1.4 SUBMITTALS

A. Product Data: Manufacturer’s data sheets for each product to be provided.

B. Detail Drawings: Provide roofing system plans, elevations, sections, details, and details of attachment to other Work, including:

1. Base flashings, cants, and membrane terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns.

C. Verification Samples: Provide for each product specified.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in “Performance Requirements" and “Guarantees” Article.

1. Provide evidence of meeting performance requirements and intent to guarantee. F. Qualification Data: For Installer and manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

H. Maintenance Data: Refer to Johns Manville’s latest published documents on www.specJM.com.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive the specified manufacturer's guarantee.

B. Manufacturer Qualifications: Qualified manufacturer that has UL or FMG approval for roofing system identical to that used for this Project.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. D. Test Reports:

1. Roof drain and leader test or submit plumber’s verification.
2. Roof deck fastener pullout test.

E. Source Limitations: Obtain all components from the single source roofing manufacturer guaranteeing the roofing system. All products used in the system must be labeled by the single source roofing manufacturer issuing the guarantee.

F. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL or FMG and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.

2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.8 GUARANTEE

A. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.

1. Single-Source special guarantee includes roofing plies, base flashings, liquid applied flashing, roofing membrane accessories, roof insulation, fasteners, substrate board, manufacturer’s expansion joints and other single-source components of roofing system marketed by the manufacturer.

2. Guarantee Period: **15** years from date of Substantial Completion.
3. Wind Rider: Guarantee shall not exclude coverage for wind events up to 120 mph.
4. Hail Rider: Guarantee shall have no exclusions for hail events up to 1 inch.
5. Accidental Puncture Rider: Guarantee shall provide coverage for accidental puncture for up to 8 billed repair hours per year for the life of the guarantee.

B. Installer’s Guarantee: Submit roofing Installer's guarantee, including all components of roofing system for the following guarantee period:

1. Guarantee Period: Two Years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC POLYOLEFIN ROOFING (TPO) MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin (TPO) Sheet: ASTM D 6878, uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced. All products shall be supplied by Johns Manville (JM TPO Products) or single sourced by approved equal.

1. Thickness: 60 mils (1.52 mm), nominal.
2. Accelerated Weathering: Minimum of 24,000 hours without cracking or crazing as tested using ASTM G155.
3. Tensile Strength: Minimum of 300 lbf as tested using ASTM D751
4. Tearing Strength: Minimum of 85 lbs as tested using ASTM D751

2.2 AUXILIARY Roofing Materials

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.

C. Sheet Flashing: Manufacturer's unreinforced sheet flashing of same material as sheet membrane.

D. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel, with anchors.

E. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, pre-punched.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosionresistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

2.3 AUXILIARY ROOFING System Components

A. Expansion Joints: Provide factory fabricated weatherproof, exterior covers for expansion joint openings consisting of flexible rubber membrane, supported by a closed cell foam to form flexible bellows, with two metal flanges, adhesively and mechanically combined to the bellows by a bifurcation process. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee.

B. Metal Flashing Sheet: Metal flashing sheets used for coping systems, fascia systems, and other similar systems detailed on plans or required for a complete roofing system are specified in Division 07 Section "Sheet Metal Flashing and Trim."

C. Gypsum Board Base Layer for Fire Protection: ASTM C1177, glass-mat faced, water-resistant gypsum substrate, 5/8 inch (16 mm) thick type “X” Securock.

2.4 COVER BOARD

A. High-Density Polyisocyanurate: Invinsa Roof Board high-density polyisocyanurate technology bonded in-line to mineral-surfaced, fiber glass reinforced facers with greater than 125 lbs of compressive strength.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated. B. Polyisocyanurate Board Insulation System: ENRGY 3, ASTM C 1289, Type II.

1. Provide insulation package with R Value greater than R-25.
2. Provide insulation package with minimum thickness of 2.5” per panel. Provide multiple layers to prevent thermal drift.
3. Insulation shall be installed in multiple layers with the minimum being two (2).

2.6 TAPERED INSULATION

A. Tapered Insulation: ASTM C 1289, provide factory-tapered ENRGY 3 insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated. Note, at backslopes, two layers, or 1/2" per 12 inches, will be required to maintain a ¼ in per 12 inch positive slope.

2.7 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosionresistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer.

D. Urethane Adhesive: Manufacturer’s two component urethane adhesive formulated to adhere insulation to substrate.

E. Wood Nailer Strips: shall be treated where required.

2.8 SUBSTRATE BOARD

A. Substrate Board where required: ASTM C 728, Fesco perlite board, 3/4 inch (19 mm) and tapered where required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and remover from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck according to recommendations in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturer's written instructions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 INSULATION INSTALLATION

A. Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation boards with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with like material.

E. Install multiple layers of insulation as specified under area of roofing to achieve required thickness. Install layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

F. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

H. Preliminarily Fastened Insulation for Mechanically Fastened Systems: Install insulation with fasteners at rate required by roofing system manufacturer or applicable authority, whichever is more stringent.

I. Mechanically Fastened with Subsequent Layers Adhered Insulation: Secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type to deck type.

1. Fasten first layer according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten first layer to resist uplift pressure at corners, perimeter, and field of roof.
3. Install subsequent layers in a two-part urethane adhesive according to roofing system manufacturer's instruction.

J. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 COVER BOARD INSTALLATION

A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

C. Install cover board with long joints of cover board in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with cover board.

1. Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.

D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.

1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

E. Adhered Cover Board: Adhere cover board to substrate as follows:
1. Install in a two-part urethane adhesive according to roofing system manufacturer's instruction.

F. Mechanically Fastened Cover Board: Install each layer of cover board and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof cover board to deck type.

1. Fasten according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten to resist uplift pressure at corners, perimeter, and field of roof.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.6 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches (1:24, contact the membrane manufacturer for installation instructions regarding installation direction and backnailing

D. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

E. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.

1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.7 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane specification ST6RM over area to receive roofing in accordance with roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical representative.

C. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

E. Always install membrane laps perpendicular to the steel deck flutes. “Picture Frame” installation method is not permitted.

F. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.

    a. Remove and repair any unsatisfactory sections before proceeding with Work.

3. Repair tears, voids, and lapped seams in roofing membrane that do not meet requirements.

H. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

I. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.

J. Through-Membrane Attachment: Secure roofing membrane using fastening plates or metal battens and mechanically fasten roofing membrane to roof deck. Cover battens and fasteners with a continuous cover strip.

K. Install roofing membrane and auxiliary materials to tie in to existing roofing.

L. Proceed with installation only after unsatisfactory conditions have been corrected.

3.8 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Flash penetrations and field-formed inside and outside corners with sheet flashing.

C. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

D. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTION AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

B. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 54 23

PART 1 GENERAL 1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counter flashings, and metal cap flashing.

B. Gutters and Supports, Downspout, Outspouts.

C. Gravel stops

D. Reglets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Through-wall metal flashings and membrane through-wall flashing for use in masonry.

B. Section 06 1000 - Rough Carpentry: Wood nailers.

C. Section 07 2129 – Closed Cell Foamed-in-Place insulation system: Through-wall membrane flashings in masonry.

D. Section 07 4113 - Metal Roof Panels: Additional flashings associated with Metal Roofing.

E. Section 07 5216 - Modified Bitumen Roofing: Additional flashings associated with Built-up Roofing.

G. Section 07 7200 - Roof Accessories: Roof-mounted units.

H. Section 07 9005 - Joint Sealers.

I. Section 08 4500 – Insulated Translucent Fiberglass Sandwich Panel Wall & Roof Assemblies

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association; latest edition.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2005.

C. ANSI/SPRI ES-1 - American National Standard for Edge Systems used with Low Slope Roof Systems.

D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a. E. ASTM B 32 - Standard Specification for Solder Metal; 2008.

F. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

G. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

H. ASTM B 370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2009.

I. ASTM B 749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2003 (Reapproved 2009).

J. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2006.

K. ASTM D 4479 - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007.

L. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007.

M. NRCA Roofing and Waterproofing Manual, fifth edition.

N. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details. C. Selection Samples; Submit as follows:

1. Submit two samples, 6" x 6" in size of each available metal finish color.
2. Manufactured items: 1'-0" length in style and finishes specified.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and the NRCA Roofing and Waterproofing Manual and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

C. All flashing, sheet metal, gutters and downspouts, and other flashings associated with roofing work and Translucent Roof Assemblies shall be provided and installed by roofing contractor and included in the roofing warranty.

1.06 PERFORMANCE

A. Coordinate the work with other work for the correct sequencing of items which make up the entire membrane of system of weatherproofing and waterproofing and rain drainage.

B. It is required that the flashing and sheet metal work be permanently watertight and not deteriorate in excess of manufacturer's published limitations.

C. Sheet metal flashing and trim shall withstand wind loads, structural movement, thermally induced movement and exposure to weather without failing.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

C. Handle materials to prevent damage to surfaces, edges and ends of sheet metal items. Reject damaged material and remove from project site.

1.08 WARRANTY

A. Finish shall be guaranteed against fading, color change, chalking, peeling, cracking, chipping or delaminating for a period of 20 years.

B. Flashing shall be guaranteed against water tightness and included in the roofing warranty. See Section 07 5216 - Modified Bitumen Roofing and Section 07 4113 - Metal Roof Panels.

C. Warrant other flashing and sheet metal work to be free of defects in materials and workmanship. Warranty period shall be two years.

PART 2 PRODUCTS 2.01 SHEET METAL MATERIALS

A. Architectural Metals: Shall be .040 pre-finished aluminum by the same manufacturer supplying metal roofing specified in Section 07 4113 where shown on plans and as required for details. Colors shall be selected by the architect.

B. Steel Sheet (Galvalume): Aluminum-zinc alloy-coated SS (structural steel) sheet conforming to ASTM A 792/A 792M; minimum AZ55 coating.

b. Steel Thickness: Minimum 24 gauge, 0.024 inch.

C. Pre-Finished Galvanized Steel: (At all exposed flashing) ASTM A 653/A 653M, with G90/Z275 zinc coating; minimum 0.0276 inch thick base metal, shop pre-coated with PVDF coating.

1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
2. Color: As selected by Architect from manufacturer's standard colors. Metal flashing associated with metal roofing shall match metal roofing panels.
3. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as selected from manufacturer's standard colors.
   a. Sheet metal shall be supplied by Metal Roof Panels contractor by same manufacturer as Metal Wall Panels as specified in Section 07 4113. D. Lead: ASTM B 749, 2.5 lb/sq ft thick.

E. Copper: ASTM B370, cold rolled 22 oz/sq ft thick; natural finish.

F. Aluminum: ASTM B 209; .040 inch thick or as indicated on drawings and elsewhere in the specifications.

2.02 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.

B. Sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work: Matching or compatible with material being installed, noncorrosive, size and gage required for performance.

C. Underlayment: ASTM D 226, organic roofing felt, Type II ("No. 30").

D. Slip Sheet: Rosin sized building paper.

E. Primer: Zinc chromate type.

F. Protective Backing Paint: Asphaltic mastic, ASTM D 4479 Type I.

G. Bituminous Coating: FS TT C 494, or Mil C 18480, or SSPC Paint 12, cold applied bituminous mastic, compounded for 15 mil dry film-thickness coatings. H. Sealant: See Section 07900. I. Plastic Cement: ASTM D 4586, Type I.

J. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape; Springlok Flashing System, Type SM manufactured by Fry Reglet or approved equal. K. Solder: ASTM B 32; Sn50 (50/50) type.

2.03 FABRICATION

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual", NRCA Roofing and Waterproofing Manual, and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work without excessive oilcanning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to form hems. Form sheet metal work with clear, sharp and uniform arises.

B. Form sections true to shape, accurate in size, square, and free from distortion or defects.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form material with flat lock seams for non-moving seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams. Fill seams with exterior sealant as specified in Section 07 9005 Joint Sealers.

F. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in

compliance with SMACNA standards. Sealant shall be installed in such a manner to be protected from UV deterioration.

G. Tin edges of copper sheet to be soldered. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints.

H. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

I. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

J. Fabricate flashings to allow toe to extend 2 inches over roofing cap sheet. Return and brake edges.

K. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

L. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
   1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

M. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

N. Cap Flashing: Provide sheet metal cap flashing at top edges of base flashings and as shown on drawings.

O. Parapet Cap: Parapet cap shall be 24 gauge galvanized steel. Cap shall be installed in 12' long lengths minimum with butt type joints. Furnish a 6" joint plate to provide positive expansion and contraction. Provisions shall be made for concealed anchorage of the face of the cap with continuous hold-down clips. All corners shall be pre-fabricated to insure water tight joints. All caps to be set straight and true.

P. Gravel Stops: Galvanized steel gravel stops shall be 24 gauge thick of size and shape detailed. Finish to match exposed flashing as specified herein.
   1. Provide gravel stops and fascia at exposed edges of all built-up roofs as indicated on the drawings. Gravel stops and fascia shall be formed from 8 to 10 foot sheets of sheet metal as long as possible with no more than one piece less than 10' long in a single run.
   2. One flange shall be formed to extend not less than 6" on to the roof. Do not face nail gravel stops.
   3. The top of the gravel stop shall extend not less than 1" in height above the level of the built-up roofing. The bottom of the fascia portion shall have 3/4" fold bent outward at a 45 degree angle and shall be hooked over a previously installed continuous edge strip fabricated from 24 gage galvanized steel.
   4. End joints shall lap 3" with the back member taper cut.
   5. The lap of the roof and the gravel stop shall be coated with non-hardening mastic. A minimum allowance of 1/4" per 10 foot length must be made for expansion.
   6. Cover plate expansion joints formed to the exact profile of gravel stop and fascia may be used.

Q. Counterflashings: Solder all seams. Provide circular copper covers soldered and mechanically attached to all penetrations. Covers shall extend 2" beyond all edges.

R. Pitch Pockets: If required on drawings, shall be manufactured of 22 oz. copper in size as required for conditions. Solder all seams.

S. Pitch Pocket Hats: Shall be fabricated of 22 ounce copper. Attached with pop rivets and seal joints. Provide for all new and existing pitch pockets. Covers shall extend 2" beyond all edges.

T. Curb Flashing: At unexposed locations, 22 oz copper where noted on drawings. Solder all seams.

U. Plumbing Vents: Shall be of 4 lb. lead turned into vent 1" minimum.

V. Scuppers: Roof Scuppers and Overflows, where indicated, shall be manufactured of 12 Ga. stainless steel as shown on plans. All seams shall be welded for water tightness. Prime prior to flashing with roofing felts. Wrap exposed stainless steel with metal matching parapet caps or brick color as determined by the Architect.

W. Miscellaneous Exposed Flashing: Shall be match exposed flashing as specified herein.

X. Reglets: Reglets shall be Fry Reglet Springlok Flashing System, Type SM snap lock, as shown on plans or approved equal.

Y. Slip Sheet: 5 lb/square red rosin building paper conforming to FS UU-B-790, Type I, Style 1b.

Z. Fasteners: Same material or compatible with sheet metal being fastened. Provide type, length and gauge recommended by the producer of the metal sheets. Fasteners shall not invalidate finish warranty.

1. Nails: Flathead, needle point, not less than 12 ga. and of sufficient length to penetrate substrate 1" minimum.
2. Expansion Shields: Lead or bronze sleeves.
3. Screws: Self-tapping type, with round heads.
4. Bolts: Furnished complete with nuts and washers.
5. Rivets: Round head, solid shank.
6. Blind Clips and Cleats: Same gauge as sheet metal.
7. Termination Bar: 1" high, continuous.

2.04 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: Reference Standard: SMACNA Architectural Sheet Metal Manual, Profile as indicated on drawings. Gutters and brackets including radius gutters will be custom size and profile aluminum gutters and brackets by W.P. Hickman Company (828-274-4000) or approved equal.

1. Gutters and Brackets to be .125 aluminum unless noted otherwise in details.
2. 1” wide .050” thick internal aluminum stap 30” o c. with continuous .125 thick external hanger at bottom (see Details)
3. Include expansion joints not exceeding 40 feet maximum for long runs, locations recommended by manufacturer and approved by architect.

B. Downspouts: Rectangular profile. Provide 3 downspout straps per 10’ section.

C. Outspouts: Fully welded into the gutter profile as noted on drawings

D. Accessories: Profiled to suit gutters and downspouts. 1. Anchorage Devices: In accordance with SMACNA requirements. 2. Gutter Supports: For Straight Run Gutters Exterior and Interior

3. Downspout Supports: Brackets.

E. Exterior Finish: Kynar-500 from manufacturer’s full range of colors. Color as selected by architect. Finish color at components adjacent to translucent wall and roof panels are to match the Kynar-500 metalic finish and color of the roof and wall panel frame and trim. Color and profile to match existing gutters.

E. Splash Pans: Same metal type as downspouts, formed to 12" x 30" inches size; rolled sides of 1 inch high for inverted pan placement.

F. Downspout Boots: Cast iron as indicated on plumbing documents. Coordinate downspout tie-in with plumbing and civil. G. Seal metal joints.

2.05 PARAPET COVER FABRICATION

A. Parapet Covers: Reference Standard: SMACNA Architectural Sheet Metal Manual, Profile as indicated on drawings. Shall be .040 (or heavier as required for ANSI/SPRI ES-1 compliance) pre-finished aluminum by the same manufacturer supplying metal roofing specified in Section 07 4113. Joint covers of same metal shall have a 40 mil Perma-ply membrane strip below them fully adhered to parapet covers in addition to caulk. The covers shall be anchored at the

prescribed rate to achieve wind uplift resistance and in accordance with the wind uplift requirements of IBC 201 , Section 1504.8

Provide coping assembly that is fabricated and installed in accordance with wind loads as indicated for this project and tested for resistance in accordance with ANSI/SPRI ES-1. Contractor is to provide details and calculations, including required performance data, of parapet copings and other applicable edge conditions as part of the submittal package. The parapet coping assembly fabricator of must be an NRCA member that is sub-listed with the NRCA to fabricate such ES-1 tested compliant products.

2.06 ROOF EXPANSION JOINT ASSEMBLIES

A. Roof Expansion Joint Assemblies: Joint metals shall be .040 (or heavier as required for ANSI/SPRI ES-1 compliance) pre-finished aluminum by the same manufacturer supplying metal roofing specified in Section 07 41 13. Construct expansion joints as a raised curb with a sloping .040 (or heavier as required for ANSI/SPRI ES-1 compliance) pre-finished aluminum cover with interlocking standing seam joints at a maximum spacing of 10 feet. Secure with concealed fasteners every 8" on one side of the joint. The opposite side shall allow for expansion and contraction. Height shall be in accordance with manufacturer's recommendations. Expansion joint assemblies shall be in strict accordance with the SMACNA Architectural Sheet Metal Manual (5th Edition) and expansion joint details per Figure 5-6. Prior to installing expansion joint flashing install insulated envelope fold and cover joint with 20 mil PVC continuous flashing. The covers shall be anchored at the prescribed rate to achieve FM I120 uplift resistance and in accordance with the wind uplift requirements of IBC 201 , Section 1504.8

Provide coping/expansion cover assembly that is fabricated and installed in accordance with wind loads as indicated for this project and tested for resistance in accordance with ANSI/SPRI ES-1. Contractor is to provide details and calculations, including required performance data, of parapet copings and other applicable edge conditions as part of the submittal package. The coping/expansion assembly fabricator of must be an NRCA member that is sub-listed with the NRCA to fabricate such ES-1 tested compliant products.

PART 3 EXECUTION 3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

C. Do not proceed until unsatisfactory conditions have been corrected. Commencement of the work of this section shall indicate acceptance of substrate.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

D. Underlayment: Where metal is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of 15 lb. Roofing felt.

3.03 INSTALLATION

A. Roofing Contractor shall supervise the installation of counter flashings, metal reglets, nailing strips, roofing penetrations and all other miscellaneous flashing or work that will be in contact with the built-up roofing or preformed metal roofing. Isolate dissimilar metals in contact with each other with a layer of felt or by a coating of plastic cement. Separate aluminum work from dissimilar metals, wood and from cementitious materials with a 15 mil dry film thickness bituminous coating to either the substrate or to aluminum.

B. Conform to drawing details, approved shop drawings, and standard details from SMACNA Architectural Sheet Metal Manual or NRCA Roofing and Waterproofing Manual.
   1. Counter Flashings: SMACNA Architectural Sheet Metal Manual, Detail 4-4C.
   2. Roof Penetration Flashing: SMACNA Architectural Sheet Metal Manual, Detail 414B.
   3. All Roof Edge Flashing and Trim: ANSI/SPRI ES-1

C. Underlayment: Where metal is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of 15 lb. Roofing felt.

D. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

E. Secure flashings in place using concealed fasteners for all flashings exposed to view. Use exposed fasteners only where permitted.(at concealed locations).
   1. Secure sheet metal items using continuous cleats, clips and blind fasteners as indicated. F. Apply plastic cement compound between metal flashings and felt flashings.

G. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

H. All metal flashing, counterflashing, pitch pans, and reglets shall be formed on a bending brake. Shaping, trimming and hand seaming is to be done on a bench, insofar as is practical with the proper sheet metal working tools. Angles, bends and folds, which are interlocking the metal, shall be made with allowances for expansion and contraction to avoid buckling and/or fullness.

I. Counterflashing: Extend into the wall as shown and turned up and shall extend down face of wall overlapping the base flashing 4" and end laps shall be at least 4". Butter all joints. Install counter flashings in reglets or receivers. Secure in a waterproof manner.

J. Perform field joining of lengths as specified for shop fabrication. Factory form and join interior and exterior corners and similar transactions.

K. Seaming: Form seams in direction of flow. Seams shall be flatlock with cleats filled with exterior sealant. Lap seams occurring in members sloping 45° or more 4" minimum and bed in flashing cement.

L. Install exposed sheet metal work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weatherresistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

M. Seal metal joints watertight.

N. Secure gutters and downspouts in place using concealed fasteners.

O. Slope gutters 1/4 inch per foot minimum.

P. Connect downspouts to downspout boots where shown on drawings. Grout connection watertight.

Q. Set splash pans under downspouts.

3.04 SOLDER JOINTS

A. Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches, except where pretinned surface would show in finished Work:
   1. Do not solder aluminum.
   2. Pretinning is not required for the following metals:
      a. Lead.
      b. Lead-coated copper.
      c. Terne-coated stainless steel.

3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.05 PLUMBING VENTS

A. After vents through roof have been set by plumber, they shall be flashed in accordance with roofing manufacturer's printed recommendations. Roofing contractor shall be responsible for flashing all plumbing vents, roof drains, etc.

3.06 CLEANING AND PROTECTION:

A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.

B. Protection: Installer shall advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

3.07 FIELD QUALITY CONTROL

A. See Section 01 4001, 01 4523 along with product related sections for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements. See Section 07 5216 - Modified Bitumen Roofing and Section 07 4113 - Metal Roof Panels for additional quality control requirements.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof hatches.
2. Roof hatch railings
3. Roof hatch ladder-assist posts
4. Downspout Splash Blocks

B. Roof hatches, roof hatch rail and ladder-assist posts are to be from a single source manufacturer.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

B. Shop Drawings: For roof accessories.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS A. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 WARRANTY

A. Provide manufacturer's standard warranty as indicated on the products listed in the specification.

PART 2 - PRODUCTS

2.1 DOWNSPOUT SPLASH BLOCKS

A. Downspout Splash Blocks shall be provided for downspouts except those to be tied into storm drainage system including those at high roof to low roof areas. Splash blocks shall be pre-cast concrete.

2.2 ROOF DRAINS

A. Roof drains will be supplied by the plumber and installed by the roofing contractor. Coordinate the size and location of opening between the roofer general contractor, plumber and other subs as needed. The general contractor shall reinforce all penetrations through decks with angles as specifications in Section 05 3100.

2.3 PIPE AND PLUMBING VENT FLASHING

A. Pipe and plumbing vent flashings shall be of one piece construction and fabricated from an EPDM membrane and shall have an aluminum base that can be field conformed to any panel configuration. Pipe flashings shall be flexible for mounting on any roof slope. Service temperature ranges shall be -30° F to +250° F. Three standard flashing sizes shall accommodate pipe sizes from 1/4" diameter up to 13" diameter. Pipe shall be located between roof seams at sufficient distance from seams to permit pipe flashing to rest flat on roof panel. Pipe flashing shall be isolated from the metal roof to prevent galvanic reactions from dissimilar metals. This product shall be as manufactured by Dektite or approved equal.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.

C. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C), thickness as indicated.

D. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.

E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick. F. Underlayment:

1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
3. Slip Sheet: Building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum, rosin sized.
4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
5. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

J. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.

C. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.2 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.
B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.
D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

Periodic

PART 1 GENERAL

A. Work includes sealing and caulking of joints where indicated on drawings, specified herein, and where required for a complete weather tight installation.

1.01 SECTION INCLUDES: Typical locations include, but are not necessarily limited to, the following: A.

Sealants and joint backing.

B. Precompressed foam sealers.

C. Applications include:
1. General Caulking (door frames, windows, other openings, etc.)
2. Exterior and interior perimeter of hollow metal door frames.
3. Exterior and interior perimeter of Aluminum Entrances, Curtain Wall, and Storefront Work.
4. Exterior wall joints
5. Control and expansion joints
6. Flashing and coping joints
7. Joints in precast concrete
8. Interior wall and ceiling joints
9. Where one partition or wall abuts another and is not structurally bonded.
10. Joints between dissimilar materials

1.02 RELATED REQUIREMENTS:

A. Section 07 2500 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders:

C. Section 07 8400 - Firestopping and Smoke Seals: Firestopping sealants.

D. Section 08 8000 - Glazing: Glazing sealants and accessories.

E. Section 09 2116 - Gypsum Board Assemblies F. Section 09 3000 - Tiling: Sealant used as tile grout.

1.03 REFERENCE STANDARDS:

A. ASTM C 834 - Standard Specification for Latex Sealants; 2010.

B. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications; 2008.

C. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2010.

D. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.

E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.04 DEFINITIONS:

A. Sealant: A weatherproof elastomer used in filling and sealing joints, having properties of adhesion, cohesion, extendibility under tension, compressibility and recovery; shall be designed to make joints air and water tight. Material is designed generally for application to joints at exterior of structures and for other joints subject to movement.
B. Caulking Compound: A material used in filling joints and seams, having properties of adhesion and cohesion; shall not be required to have extensibility and recovery properties, usually applied to joints at interior of structures.
C. Caulk: The process of filling joints, without regard to type of material.

D. Joint Failure: A caulked joint exhibiting one or more of the following characteristics:
   1. Leaks air and/or water
   2. Sealant migrates
   3. Sealant loses adhesion
   4. Sealant loses cohesion
   5. Sealant does not cure
   6. Sealant discolors
   7. Sealant stains on adjacent work
   8. Sealant develop bubbles, air pockets or voids

1.05 SUBMITTALS:

A. See Section 01 3300 - Submittal Procedures.

B. Product Data: Submit two copies of manufacturer's specifications, recommendations and installation instructions for sealant and associated miscellaneous material required. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that material complies with requirements and is intended generally for applications shown. Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability. Show by transmittal that one copy of each recommendation and instruction has been distributed to Installer.

C. Approval of Applicator: A letter certifying that applicator is approved at the time of bidding by manufacturer.

D. Color Samples:

   1. Submit two samples, 1/4 x 2 inch in size of manufacturer's standard and special colors as indicated at least 30 days prior to commencement of application.
   2. Samples shall be actual materials or literature depicting actual material colors. Architect reserves the right to reject work not in conformance with selected colors, based upon samples submitted.
   3. Should Contractor select a manufacturer meeting specified requirements, except for minimum color range requirements, he shall be responsible for furnishing special colors within range requirements. Special colors shall be submitted for Architect's acceptance.

E. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

F. Qualification Data: Submit applicator's qualifications, including reference projects of similar size, scope and complexity, with current phone numbers and contact names of architects, contractors and owners for verification.

G. Warranty: A warranty from the applicator upon completion guaranteeing the water tightness of the sealant installation for a period of five (5) years assuming responsibility for prompt and complete repair of any leaks occurring during this period. In addition, provide a letter on the manufacturer’s letterhead at project close-out stating that work has been accomplished in accord with this specification and with manufacturer's application directive.

1.06 QUALITY ASSURANCE:

A. General Performance: Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging as indicated for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials with workmanship.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by the sealant manufacturer.

1.07 DELIVERY AND STORAGE:

A. Store in sealed and labeled containers. Containers shall bear the date of packaging the physical and chemical characteristics, shelf life and application instructions. B. Comply with manufacturer's storage requirements.

1.08 FIELD CONDITIONS:

A. Weather Conditions
1. Install no materials under adverse weather conditions, or when temperatures are below or above those recommended by the manufacturer.
2. Proceed with work only when forecasted weather conditions are favorable for joint cure and development of high early bond strength.
3. Wherever joint width is affected by ambient temperature variations, install materials only when temperatures are in lower third of manufacturer's recommended installation temperature. Coordinate time schedule with Contractor to avoid delay of project.

B. Protection of adjacent surfaces:
1. Protect by applying masking materials or manipulating application equipment to keep materials in joint. If masking materials are used, allow no tape to touch cleaned surfaces to receive sealant. Remove tape immediately after caulking, before surface skin begins to form.
2. Remove misapplied sealants from surfaces using solvents and methods recommended by manufacturer.
3. Restore surfaces from which sealants have been removed to original condition and appearance.

1.09 SERVICES OF MANUFACTURER'S REPRESENTATIVE

A. Manufacturer of sealant materials shall provide the services of a factory representative who shall conduct periodic on site checking of caulking work to determine compliance with manufacturer's application directive.

1.10 APPLICATORS

A. Subcontract the caulking and sealing work to a firm experienced in the application of the types of materials required, employing skilled tradesmen for the work and who are approved by the manufacturer of the materials.

1.11 WARRANTY:

A. See Section 01 7839 - Project Record Documents, for additional warranty requirements.

B. Correct defective work within a five-year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, stain adjacent work, develop voids or do not cure. In addition, provide a letter on the manufacturer’s letterhead at project close-out stating that work has been accomplished in accord with this specification and with manufacturer's application directive.

PART 2 PRODUCTS

2.01 GENERAL:

A. Provide colors as selected by Architect.

B. Select materials for compatibility with joint surfaces and other indicated exposures, and except as otherwise indicated select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.

C. Where exposed to foot traffic, select marketing materials of sufficient strength and hardness to withstand stiletto heel traffic without damage or deterioration of sealer system.

D. Provide only sealants, joint fillers and other materials (manufacturer's recommended variation of the specified materials) which are known to be fully compatible with the actual installation conditions, as shown by the manufacture's published data or certification.

2.02 PERFORMANCE REQUIREMENTS:

A. Low-Emitting Materials: Sealants and sealant primers used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.03 SEALANTS:

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. General Purpose Exterior Sealant: Polysulfide; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single, or multi- component.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Products:
      a. Sonolastic NP-1 manufactured by Sonneborn Products (BASF Chemical Co.)
      b. Pecora GC9 Synthacalk
      c. Tremco DYmeric
      d. Substitutions: See Section 01 6000 - Product Requirements.
   3. Applications: Use for:
      a. Control, expansion, and soft joints in masonry.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. Other exterior joints for which no other sealant is indicated.

C. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
   1. Applications: Use for:
      a. Concealed sealant bead in sheet metal work.
      b. Under thresholds.
   2. Products
      a. BA-98 by Pecora Corporation
      b. Chem-Calk 300 by Bostick
      c. Substitutions: See Section 01 6000 - Product Requirements.

D. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Products:
   a. Sonolac manufactured by (BASF Chemical Co.)

b. AC-20+ Silicone by Pecora Corporation
c. Tremflex 834 by Tremco
d. Substitutions: See Section 01 6000 - Product Requirements.
3. Applications: Use for:
a. Interior wall and ceiling control joints.
b. Joints between interior door and window frames and wall surfaces.

E. Acoustical Sealant: Non-skinning, non-hardening synthetic rubber sealant; single component. Sealant shall increase the STC value of a system through the joint when one or more beads are applied to a joint. Sealant shall inhibit air movement and buffer vibration to reduce sound transmission. Sealant conforms to CAN/CGSB 19.21 M87 (QPL #60963-H).
1. Products:
a. Pecora AC20 FTR Fire and Temperature Rated Acoustical and Insulation Rated Sealant
b. Acoustical Sealant manufactured by Tremco Commercial Sealants and Waterproofing or approved equal.
c. Substitutions: See Section 01 6000 - Product Requirements.
2. Applications: Use for:
a. Expansion joints in floors.
b. Joints between dissimilar materials in sound-rated walls, floors and ceilings including, but not limited to all classrooms and instructional spaces.

F. Self-Leveling Polyurethane Sealant: ASTM C 920, Grade P, Class 25, Uses T, I, M, A, O; multi-component, chemical curing, non-staining, non-bleeding, self-leveling type.
1. Color: Gray.
2. Movement Capability: Plus, and minus 25 percent.
a. Service Temperature Range: -40 to 180 degrees F.
3. Shore A Hardness Range: 20 to 35.
4. Applications: Use for:
a. Horizontal Joints subject to foot traffic.
5. Products:
a. UREXPAN NR-200 by Pecora
b. THC-900 by Tremco
c. TF-100 by BASF
d. Substitutions: See Section 01 6000 - Product Requirements.

G. Silicone Sealant: ASTM C 920, Grade NS, Class 50, Uses NT, A, G, M, O; single component, solvent curing, non-sagging, non-staining, fungus resistant, non-bleeding.
1. Color: Standard colors matching finished surfaces.
2. Products:
a. Omniseal 50 manufactured by BASF
b. Pecora 896 as manufactured by Pecora Corporation.
c. Spectrem 3 manufactured by Tremco, Inc.,
d. Substitutions: See Section 01 6000 - Product Requirements.
3. Movement Capability: Plus, 50 percent, minus 25 percent.
4. Service Temperature Range: -65 to 180 degrees F.
5. Shore A Hardness Range: 15 to 35.
6. Applications: Use for:
a. Joints in aluminum storefront and curtain wall framing system.

H. Single Component Sanitary Silicone: ASTM C920, Type S, Brade NS, Class 25; Uses NT, A and O. Single component, color as selected meeting VOC requirements of pertinent CARB and/or

SCAQMD Rule for sealants VOC (4% by weight VOC or less in smaller than 16 oz package or less than 250 g/L in larger package).

1. Color: To be selected by Architect from manufacturer's standard range.
2. Products:
    a. Pecora 898 - Sanitary Mildew Resistant Silicone Sealant
    b. Tremsil 200 by Tremco Inc.
    c. Substitutions: See Section 01 6000 - Product Requirements.
3. Applications: Use for:
    a. Interior sanitary applications, countertops, backsplashes, lavatories, plumbing fixtures, etc.

2.04 COMPATIBILITY:

A. Before purchase of the specified sealant, investigate its compatibility with the joint surfaces, joint fillers and other materials behind or below the joint in the construction. Provide only materials (manufacturer's recommended variation of the specified materials) which are known to be fully compatible with the actual installation conditions, as shown by the manufacture's published data or certification.

2.05 ACCESSORIES:

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; closed cell polyethylene; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

E. Sealant Backer Rod: Compressible rod stock of closed cell polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam as recommended by sealant mfg. for compatibility with sealant material. Provide size and shape of rod to control joint depth, break bond at bottom of joint, form optimum shape of bead on back size to minimize possibility of extrusion when joint is compressed.

F. Tooling Agent: Agent recommended by sealant manufacturer to insure contact of material with inner joint faces.

G. Divider strips: Synthetic rubber or closed cell synthetic foam not less than 1/6" thick and full depth of sealant; approved by manufacturers of dissimilar materials as being compatible with each other.

PART 3 EXECUTION

3.01 FIELD MOCKUP:

A. Prepare, caulk and finish one sample of each joint condition.

B. Sample joints shall be accepted by Architect prior to beginning work. Retain approved samples as a standard for work.

C. Only neat tooled joints will be accepted.

3.02 EXAMINATION:

A. Verify that substrate surfaces and joint openings are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.
D. Protect elements surrounding the work of this section from damage or disfigurement.

E. Do not proceed with the work of this section until unsatisfactory conditions have been corrected.

3.02 JOINT SURFACE PREPARATION:

A. Protect by applying masking materials or manipulating application equipment to keep materials in joint. If masking materials are used, allow no tape to touch cleaned surfaces to receive sealant. Remove tape immediately after caulking, before surface skin begins to form.

B. Installer must examine joint surfaces, backing and anchorage of units forming sealant rabbet and conditions under which sealant work is to be performed and notify Contractor in writing of any conditions detrimental to proper and timely completion of work. Do not proceed with sealant work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

C. Clean joint surfaces immediately before caulking joints. Remove dirt, insecure coatings, moisture and other substances which could interfere with bond

D. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's product data indicates that alkalinity does not interfere with bond and performance. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution; rinse with clean water and allow to dry before caulking.

E. Roughen joint surfaces on vitreous coated and similar non-porous materials, unless sealant manufacturer's product data indicates equal bond strength as porous surfaces. Rub with fine abrasive cloth or wool to produce dull sheen.

3.03 INSTALLATION:

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
   1. Seal all interior and exterior openings, joints, and flashings and all other places as necessary to provide watertight installation.

D. Remove dirt, unsecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound. Joints should be clean, dry and free from foreign matter.
   1. In masonry joints avoid contamination of water-proofing, form release and curing agents. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's product data indicates that alkalinity does not interfere with bond and performance. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution; rinse with clean water and allow to dry before caulking.
   2. On aluminum surfaces, remove protective coating with a Xylol or MEK wipe.

E. Prime or seal joint surface where recommended by sealant manufacturer. Roughen joint surfaces on non-porous materials unless manufacturer's product data indicates equal bond strength as porous surfaces. Rub with fine abrasive cloth or wool to produce dull sheen. F. Perform installation in accordance with ASTM C 1193.

G. Perform acoustical sealant application work in accordance with ASTM C 919.

H. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

I. Install bond breaker where joint backing is not used.
J. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

K. The sealant shall be applied by gun with nozzle diameter to match the width of the joint so as to fill the opening completely.
   1. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces.
   2. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
   3. Caulking around openings in masonry shall include the entire perimeter of each opening.

L. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges. M. Tool joints concave.

N. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces including rough textures. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or the sealer/caulking compound.

O. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch below adjoining surface.

P. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/8 to 1/4 inch below adjoining surface.

3.04 CLEANING:

A. Clean adjacent soiled surfaces.

B. Remove misapplied sealants from surfaces using solvents and methods recommended by manufacturer.

C. Restore surfaces from which sealants have been removed to original condition and appearance.

3.05 PROTECTION:

A. Protect sealants until cured.

END OF SECTION

1.0 GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of contract, including general and supplementary conditions and division - 1 specification sections, apply to work of this section.

1.02 QUALITY ASSURANCE:

A. Furnish Expansion Control System as a complete unit produced by one manufacturer.

B. Manufacturer: Provide Expansion Control System as manufactured by one of the following: Balco, Inc.
Watson Bowman
Conspec Systems, Inc.
Construction Specialties, Inc.
M Systems Corporation

C. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay work.

D. Coordination: Furnish inserts and anchorages which must be built into other work; coordinate delivery with other work to avoid delay.

E. Building expansion joints are indicated on the drawings. Provide joints and joints covers at all building expansion joint conditions whether detailed on the drawings or not.

1.03 SUBMITTALS

A. Product Data: Submit 2 copies of mfg.'s detailed technical data for materials, fabrication, and installation instructions for all phases of the work, including preparation of substrate, application, and protection of installed units.

B. Shop Drawings: Submit shop drawings for assembly and installation of expansion joint system not fully described by product data submission, for installation of anchorage devices built into other work.

2.0 PRODUCTS

2.01 MATERIALS

A. Aluminum - Comply with ASTM B221 alloy 6063-T5 for extrusions; and ASTM B 209 alloy 6061-T6 for sheet and plate.

B. Finishes: Manufacturer's standard finish, with Aluminum Floor Systems of "mill finish" and zinc chromate primer in contact with concrete. Aluminum covers other than floors shall be "satin anodized finish".

2.02 ACCESSORIES:

A. Manufacturer's standard anchors, fasteners, set screws, spacers, flexible seal and filler materials, adhesive and other accessories compatible with material in contact; as shown or required for complete installations.

B. Provide fire caulk required by manufacturer’s details at fire rated joints.

2.03 EXPANSION CONTROL SYSTEMS: The referenced catalog numbers as noted below and on plans shall be by BALCO, Inc. and are to establish product quality, size, metals, metal gauges, color, and like specification requirements, and is not intended to limit competition. All metals listed shall be stainless steel.

A. Fire rated wall covers shall be UL rated meeting fire ratings shown on plans: Models WW-S-2002 or WW-S-2006 as required on each side of wall. (Similar at corners.)

B. Fire rated floor covers shall be the FRB series meeting ratings as shown on plans. Floor joints must contain a continuous water tight seal/filler to prevent the passage of water from floor to floor.

C. Non-rated floor covers shall be SS6FS series as required for openings and SS6FVS at floor to wall joints.

D. Ceilings shall be Type C2W2 and C2C2 at wall ceilings.

3.0 EXECUTION

3.01 INSPECTION:

A. Installer must examine substrates, previously installed inserts and anchorage, and other conditions under which installation is to occur, and must notify contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

A. Manufacturer's Instructions: In addition to the requirements of these specs, comply with mfg.'s instructions and recommendations for all phases of the work, including preparation of substrate, applying materials, and protection of installed units.

B. Cutting, Fitting and Placement: Perform all cutting, drilling and fitting required for the installation of the items. Set the work accurately in location, alignment and elevation, plumb, level, true, measured from established lines and levels. Provide temporary bracing or anchors in form work for items which are to be built into concrete, masonry or similar construction.

C. Install joint cover assembled in true alignment. Set floor covers at elevations to be flush with adjacent finished floor materials. Locate ceiling covers in continuous contact with adjacent surfaces. Securely attach in place with all required accessories. Locate anchors approximately 3" from each end, 12" o.c. between ends for set screws, and 18" o.c. between ends for other fasteners, unless closer spacing is recommended by the mfg. Hold end joints to the minimum; make end joints with strong, rigid, mechanical splice plate in true alignments, with hairline joints.

3.03 CLEANING AND PROTECTION

A. Do not remove strippable protective material until finish work in adjacent areas is complete. When protective material is removed, clean exposed metal surfaces in accordance with manufacturer's written instructions.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior and interior aluminum-framed storefronts.

a. Glazing is retained mechanically with gaskets on four sides.

2. Exterior and interior manual-swing aluminum doors.
3. Exterior and interior aluminum door frames.
4. Aluminum-framed storefront systems complete with reinforcing, shims, anchors, all trim accessories as shown on the drawings.

B. Each opening is to be engineered by the entrance and storefront manufacturer's qualified professional engineer.

C. The contractor is to provide all required attachments and anchoring components as required for proper anchoring to the building structure and for full compliance with the wind resistance requirements for this project. Any and all such components are to be included in the contractor's bid whether shown on the architectural drawings or not.

1.2 PERFORMANCE REQUIREMENTS

A. General: Provide aluminum-framed systems, including all anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:

a. Deflection exceeding specified limits.
b. Thermal stresses transferred to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
d. Glazing-to-glazing contact.
e. Noise or vibration created by wind and thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant failure.
h. Failure of operating units to function properly.

B. Structural-Sealant Joints: Designed to produce tensile or shear stress in structuralsealant joints of less than 20 psi (138 kPa). C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
2. Seismic Loads: As indicated on Drawings.

Deflection of Framing Members Normal to Wall Plane: Systems tested according to ASTM E 330 as follows: Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures shall be limited to L/180 of its clear span. D.

Structural-Test Performance: Systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity but not less than 10 seconds.

E. Temperature Change (Range): Systems accommodate 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

F. ASTM E 283 requires using a static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa), unless otherwise indicated, which is equivalent to a 25-mph (40-km/h) wind. Static-airpressure difference of 6.24 lbf/sq. ft. (300 Pa) is equivalent to a 50-mph (80-km/h) wind. G. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

   a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a staticairpressure differential of 6.24 lbf/sq. ft. (300 Pa)

2. Entrance Doors:

   a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

   b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. (2.54 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

H. Water Penetration Under Static Pressure: Systems do not show evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

I. Condensation Resistance: Fixed glazing and framing areas of systems have condensationresistance factor (CRF) of not less than 53 when tested according to AAMA 1503.

J. Average Thermal Conductance: Fixed glazing and framing areas of systems have average Ufactor of not more than 0.29 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.

1.3 SUBMITTALS

A. Shop Drawings and all calculations are to be prepared on manufacturer's title block and signed and sealed by the manufacturer's selected professional Structural Engineer registered in the State of South Carolina: Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the manufacturer's qualified professional engineer responsible for their preparation. The shop drawings are to also include details of all required attachments and anchoring components as required for proper anchoring to the building structure and for full compliance with the wind resistance requirements for this project. Any and all such components are to be included in the contractor's bid whether shown on the architectural drawings or not.
2. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
3. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
4. Provide hard copies formatted to read clearly on 11" x 17". B. Samples: For each exposed finish.

C. Preconstruction Sealant Test Reports: For structural-sealant-glazed systems.

D. Product test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Acceptable to manufacturer and capable of preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project. Include all anchoring devices and details whether shown on the architectural drawings or not.

D. Preconstruction Sealant Testing: For structural-sealant-glazed systems, perform sealant manufacturer's standard tests for compatibility and adhesion of sealants with each material that will come in contact with sealants and each condition required by aluminumframed systems.

1. Determine corrective measures required to prepare each material to ensure compatibility with and adhesion of sealants, including, but not limited to, specially formulated primers.

E. Structural-Sealant Glazing: Comply with recommendations in ASTM C 1401, "Guide for Structural Sealant Glazing."

F. Accessible Entrances: Comply with applicable provisions in ICC/ANSI A117.1.

G. Source Limitations: Aluminum Framed Entrances and Storefronts specified in this section along with the Glazed Aluminum Curtain Wall Systems specified in Section 08 4413 are to be provided and installed by one single source manufacturer and manufacturer's approved installer.

H. Door Finish Hardware Coordination: The Aluminum Framed Entrances and Storefront / Glazed Aluminum Curtain Wall Systems manufacturer is responsible for coordination with the finish hardware requirements of specification section 08 7100 “Finish Hardware” and the electronic access control requirements as indicated for this project. Coordination must be in a timely manner not to cause any delay in fabricating either system.

I. All punched opening frames are to be factory/shop assembled. No field fabrication.

J. Pre-installation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components to function properly.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: In addition to above, provide manufacturer's integrity warranty in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Fading – rated at less than 5 delta units over the life of the warranty
b. Chalking
c. Corrosion from salt spray and the elements

2. Warranty Period: Ten (10) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for aluminum-framed systems is based on EFCO 406, Thermal Storefront System (2” x 6 1/2”), center set. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
1. EFCO
2. Kawneer, North America 3. YKK AP America, Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
6. Minimum thickness of 0.080 inch for main framing members.

B. Internal Reinforcement: With manufacturer's standard corrosion-resistant primer.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M for carbon steel or ASTM B308 for structural aluminum.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.
4. (1 ¼" x 4 9/16" x ¼") steel channel (vertical mullions) and 1 ¼" x 4 11/16" x 12ga) steel channel (vertical jambs)
5. Steel components factory coated with alkyd type zinc chromate primer complying with FS TT-P-645.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Framing members are composite assemblies of two separate extrudedaluminum components permanently bonded by an elastomeric material of low thermal conductance.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-magnetic, non-staining, non-bleeding stainless steel or other non-corrosive fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from stainless steel.
4. Provide concealed fastening.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: Refer to Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type and as follows:

1. Structural Sealant: ASTM C 1184, neutral-curing silicone formulation compatible with system components with which it comes in contact.

a. Color: As selected by Architect from manufacturer's full range of colors. Color to match existing Storefront System.

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact.

a. Color: Matching structural sealant.

2.5 DOORS

A. Doors: Manufacturer's glazed entrance doors, for manual swing operation.

1. Door Construction: (0.188 wall thickness; 2” deep) extruded-aluminum tubular rail and stile members.

a. Thermal Construction: Non-Thermal.

b. Corner Construction: MIG welded corner construction.

2. Door Design: EFCO series D618 Durastile heavy duty, wide stile entrance door. Wide Stile 6” vertical stile, 5 1/2” top rail, 9” bottom rail and 8 ½” mid rail.

B. Door Hardware: As specified in Division 8 Section "Door Hardware."

2.6 DOOR HARDWARE (PROVIDED UNDER DIVISION 8 “DOOR HARDWARE” AND FIELD PREP AND INSTALLED BY STOREFRONT INSTALLER)

A. General: Provide heavy-duty units in sizes and types recommended by entrance system and hardware manufacturers for entrances and uses indicated.

B. Cylinders: As specified in Division 8 Section "Door Hardware."

C. Cylinder Keying: **Master** key system. Permanently inscribe each key with a visual key control number and include notation **"DO NOT DUPLICATE"**. All keying requirements are to be coordinated with the Fort Mill School District. D. Silencers: BHMA A156.16, Grade 1.

E. Aluminum framed entrance manufacturer and supplier shall coordinate access controls installation with the installer.

2.7 ACCESSORY MATERIALS

A. Insulating Materials: As specified in Division 7 Section "Thermal Insulation."

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.8 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or panels.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

E. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

F. Doors: Reinforce doors as required for installing hardware.

1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Hardware Installation: Prep and install hardware in field by storefront installer.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. Finish to match Existing Aluminum Storefronts.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Fit joints to produce hairline joints free of burrs and distortion.
2. Rigidly secure non-movement joints.
3. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
4. Seal joints watertight, unless otherwise indicated. B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce a weather-tight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Division 8 Section "Glazing." 1. Structural-Sealant Glazing:

a. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
b. Install weatherseal sealant according to Division 7 Section "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install insulation materials as specified in Division 7 Section "Thermal Insulation."

I. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

J. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch (3 mm).

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections. The agency must be AAMA accredited.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Water Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

a. Test Area: A minimum area of 300 square feet of aluminum-framed systems. Random selection of areas to be tested will be by the architect. The area to be tested should be fully assembled and ready for testing prior to the arrival of the test crew.

b. The test area should also include: perimeter caulking, typical splices, frame intersections, and at least two entire vision lites and two entire spandrel lites containing an intermediate vertical member and intermediate horizontal member.

C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports and issue to Architect within 7 days of the actual testing. END

OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, hollow steel, and aluminum doors.

B. Hardware for fire-rated doors.

C. Hardware for acoustical doors.

D. Electrically operated and controlled hardware.

E. Lock cylinders for doors for which hardware is specified in other sections.

F. Thresholds.

G. Weatherstripping, seals and door gaskets.

H. Hardware for integral doors of aluminum storefront system and curtain wall systems along with cylinders.

1.02 COORDINATION

A. The General Contractor be responsible for hanging all doors and installation of hardware.

B. Coordinate hardware for related trades such as metal doors, frames, millwork, etc.

C. Coordinate approved shop drawings from any affected trades after receipt of final approved finish hardware schedule.

D. Templates: The hardware supplier shall furnish, promptly, necessary templates and an approved hardware schedule to other trades requiring their use to enable the door manufacturers to make proper provision in their work to receive the architectural finish hardware. Other trades shall furnish to the hardware supplier such drawings and information that might be required in order that proper items of hardware be supplied. Provide only template produced units.

1.03 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 1416 - Flush Wood Doors.

C. Section 08 3313 - Coiling Counter Doors: Lockable coiling counter doors. Hardware by door manufacturer, except cylinders.

D. Section 08 3326 - Overhead Coiling Grilles: Lockable coiling grilles. Hardware by door manufacturer, except cylinders.

E. Section 08 4110 - Aluminum-Framed Entrances and Storefronts: Heavy Duty Aluminum Wide Stile and Rail Doors. Hardware by door manufacturer if not listed in the Door Hardware Schedule at the end of this section, except cylinders.

F. Section 08 4413 - Glazed Aluminum Curtain Walls: Hardware not listed in the Door Hardware Schedule at the end of this section, except lock cylinders; installation of cylinders

1.04 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2017.

B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2010.

C. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware. Coordinate schedule with Contractor in order to not delay project.

C. Convey Owner's keying requirements to manufacturers.

D. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by all affected installers.

E. Sequence installation to ensure efficient progress of the work is achieved in an orderly and expeditious manner. Building shall be lockable as soon as building is dried in. 1.06 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. LEED Submittals:
1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Certificates for Credit MR 5: For product and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

C. Product Data: Submit manufacturers technical product data for each item of hardware, marked to clearly show products to be furnished for this project. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.

D. Shop Drawings:
1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, See Section 01 6000 - Product Requirements.
2. Submit manufacturer's parts lists and templates.

E. Schedule: The hardware supplier shall submit to the Architect for approval a complete hardware schedule ten days after the award of the hardware contract. Organize hardware schedule into hardware sets indicating complete designations of every item for each door opening. Include type, style, function, finish, manufacturer, location coordinated with door schedule on drawings, door and frame types and sizes, keying and mounting heights for all hardware.

F. Samples: (If requested by Architect)
1. Submit 1 sample of hinge, latchset, lockset, and closer illustrating style, color, and finish.
2. Samples will be incorporated into the Work.

G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
1. Submit manufacturer's parts lists and templates.

H. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

I. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.08 QUALITY ASSURANCE

A. Fire-rated Openings: Provide hardware for fire-rated openings in compliance with NFPA 80 and local building code requirements. Provide only hardware which has been tested and listed by

UL of FM for types and sizes of doors required and complies with requirements of the door and frame label.

B. Americans with Disabilities Act (ADA): Provide and install finish hardware in accordance with requirements of Americans with Disabilities Act (ADA).

C. ANSI Standards for Physically Handicapped: Finish hardware shall comply with: "American National Standard for Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People" (ANSI A117.1). latest edition, by American National Standards
Institute, Inc.; New York, New York. Before installation of finish hardware, notify Architect of any Contract Documents requirements that are suspected to be in non-compliance with ANSI A117.1-2017.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

E. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with five years of experience.

F. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.
1. The AHC shall have a minimum of five years of documented experience with similar type projects.
2. A representative of the hardware supplier shall visit the job site a minimum of three (3) times during construction, and upon completion of the job shall inspect the hardware and submit a letter to the Architect in duplicate advising that the hardware has been properly installed and is operating properly.
3. The hardware supplier shall be responsible for supplying the correct hardware to meet all local and state building, fire and accessibility codes.

G. Installer Qualifications:
1. All hardware shall be installed by tradesmen skilled in the application of commercial grade hardware.
2. The installer must be approved by the Owner and Architect prior to the start of installation, and provide references of completed school projects. There will be no exceptions.
3. Installation will be handled through the general contractor, not the hardware supplier.

1.09 SCHEDULING

A. The hardware supplier shall coordinate with the General Contractor to establish dates for processing submittals, furnishing templates, delivering hardware, and installing the work of this section to meet construction progress schedule included in this Project Manual.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually with the required fasteners for proper installation; label and identify each package with door opening code to match hardware schedule.

B. Finish hardware shall be stored in a locked area and remain secured until installation.

1.11 WARRANTY

A. See Section 01 7839 - Project Record Documents, for additional warranty requirements.

B. Installer's Warranty: Installer shall guarantee in writing, that all materials specified in this section shall be free from all defects and shall perform satisfactorily for a period of one (1) year after substantial completion. Installer shall replace, at his own expense, including labor, any items of hardware which may prove defective within this period.

C. Manufacturer's Warranty: Provide manufacturer's warranty against defects in materials and workmanship as follows:
1. Locksets: 2 years

2. Door Closers: 10 years
3. Exit Devices: 3 years
4. Other Hardware: 1 year

PART 2 PRODUCTS

2.01 DOOR HARDWARE - GENERAL

A. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide all items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:
1. Applicable provisions of federal, state, and local codes.
2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities, Latest Edition.
3. Applicable provisions of 201 International Building Code.8
4. Fire-Rated Doors: NFPA 80.
5. Fire-Rated Doors: NFPA 80.
6. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.
7. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.
8. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

D. Electrically Operated and/or Controlled Hardware: Provide all power supplies, power transfer hinges, relays, and interfaces required for proper operation; provide wiring between hardware and control components and to building power connection.

C. Hardware is to be provided as scheduled at the end of this section and per the following requirements:
1. Locks & Cylinders Corbin Russwin NO SUBSTITUTIONS
2. Exit Devices Von Duprin NO SUBSTITUTIONS
3. Closers LCN NO SUBSTITUTIONS
4. Electronic Hardware & Related Components Schlage Electronics NO SUBSTITUTIONS
5. Continuous Hinges Select NO SUBSTITUTIONS

2.02 KEYING

A. Door Locks: Great grand master keyed.
1. Owner shall approve complete keying layout in writing prior to placing lock order with factory.

B. Supply keys in the following quantities:
1. 5 master keys for each master key group.
2. 5 grand master keys.
3. 5 great grand master keys.
4. 5 construction keys.
5. 5 control keys and 5 extra cylinder cores.
6. 1 change keys for each lock.

C. Provide schematic prepared by hardware supplier and instructions as to its use in design of the system.

D. The master keys along with three (3) control keys shall be sent direct to the Owner's Representative by registered mail, return receipt requested.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Set units level, plumb and true to line and location.

C. Set hardware accurately and securely anchor with attachment devices; set screws level, flush and draw up tight.

D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Do not install surface mounted items until finishes have been completed on the substrate.

F. Use templates provided by hardware item manufacturer.

G. Do not install surface mounted items until finishes applied to substrate are complete.

H. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

I. Set thresholds for exterior doors in full bed of butyl - rubber or polyisobutylene mastic sealant.

J. Mounting heights for hardware from finished floor to center line of hardware item:
   1. For steel doors and frames: See Section 08 1113.
   2. Wood doors: See Section 08 1416.

K. Installer shall:
   1. Advise the hardware supplier before proceeding with door stop installation for possible replacement if door stop scheduled for an opening is not appropriate due to furniture layout or other reasons.
   2. Provide sex nuts and bolts for door closers.
   3. Provide 4-7/8-inch lock strikes unless otherwise noted on schedule.

3.03 FIELD QUALITY CONTROL

A. Provide an Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.04 ADJUSTING

A. Adjust hardware for smooth operation and leave clean, free from defects, paint, etc.

B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

C. Final Adjustment: Final adjustment shall be done during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in project. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control device to compensate for final operation of heating and ventilating equipment. Replace any hardware which cannot be adjusted to operate freely and smoothly as intended for the application at no expense to the Owner.

3.05 CLEANING

A. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

B. Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

3.06 PROTECTION

A. Do not permit adjacent work to damage hardware or finish.

B. Do not remove labels on lock or cylinders. This label has keying information necessary for Owner's use.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Storefront framing.
4. Interior borrowed lites.
5. Acoustical Glass (STC 45) in metal frame.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2018 International Building Code by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: As indicated on Drawings.
2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for shortduration load.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches (300 mm) square. Include adhered manufacturer’s label identifying all glazing components of the sample and which side of the sample is exterior..

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. E. Preconstruction adhesion and compatibility test report.

1.5 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to

these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction and the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.

D. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.6 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions.

Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heattreated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heattreated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

C. Mirrored - Oneway Vision Glass

D. Impact-resistant Glass

E. Security Glass

F. Sound Rated Glass

2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal.
2. Spacer: Manufacturer's standard spacer material and construction

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, or silicone gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.6 GLAZING SEALANTS A.

General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT as required to meet project conditions.

C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT as required to meet project conditions.

D. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT as required to meet project conditions.

E. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 MONOLITHIC-GLASS TYPES

A. Glass Type: (For Interior Doors and Windows only)

1. Thickness: ¼" (6mm)
2. Clear, Fully Tempered Float Glass
3. Provide safety glazing labeling

2.10 EXTERIOR LAMINATED-GLASS TYPES

A. For Exterior Hollow Metal Doors: Tinted, laminated vision glass with two plies of heatstrengthened float glass. (Total thickness = 9/16").

1. Thickness of Each Glass Ply: ¼" [6.0 mm]
2. Interlayer Thickness: 0.090 inch (2.29 mm) Sentry Glass® by DuPont.
3. Outboard Lite: Class 1 Tinted Float glass
   a. Basis of Design
      1) Guardian Industries Corp., CrystalGray
4. Inboard Lite: Class 1 Clear float glass
5. Visible Light Transmittance: 62% percent minimum.
6. Winter Nighttime U-Factor: 0.95 maximum.
7. Summer Daytime U-Factor: 0.87 maximum.
8. Solar Heat Gain Coefficient: 0.59 maximum.
9. Provide safety glazing labeling.

2.11 INSULATING GLASS TYPES (For Exterior Storefront Systems) A.

Solar Control Insulated Glass Vision Unit:

1. Unit Overall Thickness 1".
2. Outdoor Lite: Class 1 Tinted, tempered float glass, ¼" [6 mm] minimum thickness.

   a. Heat-Treated, Fully Tempered.
   b. Tint Color: Light Gray
   c. Solar Control Low-E Coating: Sputtered on #2 surface.
   d. Basis of Design Product:
      1) Guardian Industries Corp., SunGuard SNX 62/27 on CrystalGray, #2 surface

      2) PPG Industries, Inc Solarban 70XL on Optigray, #2 surface.

3. Air Space: ½"
4. Indoor Lite: Class 1 (clear) float glass, ¼" [6 mm] minimum thickness; heatstrengthened (HS) float glass where required by performance requirements; fully tempered (FT) float glass where required for safety. a. Basis of Design Product
      1) Guardian Industries Corp., Clear
      2) PPG Industries, Inc., Clear

5. Visible Light Transmittance: 45 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.22 maximum.
9. Outdoor Visible Light Reflectance: 8 percent maximum.

10. Light to Solar Heat Gain: 1.99 minimum B. Solar Control Insulated Spandrel Glass Unit:

1. Unit Overall Thickness 1".
2. Outdoor Lite: Class 1 Tinted, tempered float glass, ¼" [6 mm] minimum thickness.
    a. Heat-Treated, Fully Tempered.
    b. Tint Color: Light Gray
    c. Solar Control Low-E Coating: Sputtered on #2 surface.
    d. Basis of Design Product:
        1) Guardian Industries Corp., SunGuard SNX 62/27 on CrystalGray, #2 surface
        2) PPG Industries, Inc Solarban 70XL on Optigray, #2 surface.
3. Air Space: ½"
4. Indoor Lite: Class 1 (clear) float glass, ¼" [6 mm] minimum thickness
    a. Heat-Treated, Fully Tempered.
    b. Spandrel: ICD Coatings or Ceramic Frit applied to #4 surface, 100% coverage
    c. Basis of Design Product
        1) Guardian Industries Corp.; SunGuard Spandrel HT, WarmGray
5. Visible Light Transmittance: 1 percent minimum.
6. Winter Nighttime U-Factor: 0.29 maximum.
7. Summer Daytime U-Factor: 0.27 maximum.
8. Solar Heat Gain Coefficient: 0.18 maximum.
9. Outdoor Visible Light Reflectance: 11 percent maximum.

2.12 INSULATING / LAMINATED GLASS TYPES (For Exterior Aluminum Storefront Systems, including Exterior Aluminum Doors and Exterior Aluminum Frame Systems: A. Solar Control Insulated/Laminated Glass Vision Unit:

1. Unit Overall Thickness 1 1/16"".
2. Outdoor Lite: Class 1 Tinted, tempered float glass, ¼" [6 mm] minimum thickness.
    a. Heat-Treated, Fully Tempered.
    b. Tint Color: Light Gray
    c. Solar Control Low-E Coating: Sputtered on #2 surface.
    d. Basis of Design Product:
        1) Guardian Industries Corp., SunGuard SNX 62/27 on CrystalGray, #2 surface
        2) PPG Industries, Inc Solarban 70XL on Optigray, #2 surface.
3. Air Space: 3/8" thick Argon gas filled space & mill finish air spacer.
4. Indoor Lite: SGG4, 3/8" [9 mm] minimum thickness;
    a. Basis of Design Product
        1) School Guard Glass (SGG) by LTI Smart Glass, Inc.Guardian

5. Ratings Required: 5-aa1 (6 minute), BR2 (available in some configurations), F1233
6. Visible Light Transmittance: 59 percent minimum.
7. Reflectance Visible Light: 13 percent 8. Winter Nighttime U-Factor: 0.24 maximum.
9. Shading Coefficient: .32
10. Solar Heat Gain Coefficient: 0.28 maximum.
11. Provide Safety Glazing Label

2.16 SECURITY GLAZING – Transparent Security & Sound Laminate

Glass All glass in windows and doors in Secured Entry Lobby

100

Glass Type:

1. Provide Transparent Security Laminate Glass

.25" Heat Strengthened Clear (on outside) Type A below
.06 " Clear Windborne –Debris-Impact-Resistant Laminated Glass(middle layer)Type B below
.25" Heat Strengthened Clear (on outside)Type A below

No airspace between any of the above. See the specs for the glass to make up this sample below.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer. E. Apply heel bead of elastomeric sealant.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer. E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period. END OF SECTION

PART 1 GENERAL 1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Ceramic accessories.

C. Waterproofing under tile

D. Ceramic trim.

E. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-In-Place Concrete.

B. Section 07 9005 - Joint Sealers.

C. Section 09 2116 - Gypsum Board Assemblies: Installation of tile backer board.

D. Section 22 4200 - Plumbing Fixtures:

1.03 REFERENCE STANDARDS

A. ANSI A108 Series/A118 Series/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2005.

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2005.

C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar; 1999 (R2005).

D. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the WetSet Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex Portland Cement Mortar; 1999 (R2005).

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 1999 (R2005).

F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (R2005).

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (R2005).

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (R2005).

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (R2005).

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (R2005).

K. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 1999 (R2005).

L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005.

M. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 1999 (R2005).

N. ANSI A118.4 - American National Standard Specifications for Latex-Portland Cement Mortar; 1999 (R2005).

O. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (R2005).

P. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2008.

Q. ASTM C 1178/C 1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2008.

R. TCNA (HB) - Handbook for Ceramic Tile Installation; 2010.

1.04 SUBMITTALS

A. See Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 x 18 inches in size illustrating pattern, color variations, and grout joint size variations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Tile: 2 percent of each size, color, and surface finish combination.

G. LEED Submittals:
   1. Product Data for Credit MR 4: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating cost for each product having recycled content.
   2. Product Certificates for Credit MR 5: For product and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
   3. Laboratory Test Reports for Credit IEQ 4: For adhesives, grouts, sealants and tile systems documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers" or other LEED-approved standard for VOC content.

1.05 QUALITY ASSURANCE

A. Maintain one copy of The Tile Council of North America Handbook and ANSI A108 Series/A118 Series on site.

B. Standards: Mortar and grout materials and installation standards of the American National Standards Institute (ANSI) and Standard Specification for Ceramic Tile TCNA 137.1 - 2008 apply to the work, except as otherwise indicated.

C. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.

D. Installer Qualifications: Company specializing in performing tile installation, with minimum of 5 years of documented experience.
   1. Installer shall employ skilled mechanics trained and experienced in tile work.
   2. Registered as members in good standing with the Tile Council of America or an affiliated provincial association.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

B. Deliver all products to job site in manufacturer's unopened containers with grade seals unbroken and labels intact.

C. Keep tile cartons dry and clean.

1.07 FIELD CONDITIONS

A. Maintain ambient and substrate temperature of 50 degrees F during installation and curing of mortar materials.

B. Protect Portland cement based materials from direct sunlight, radiant heat, forced hot and cold ventilation and drafts until cured, to prevent premature evaporation of moisture. When installed at low temperatures allow for longer curing time and protect from damage until cured.

C. Do not install epoxy based materials when surface temperature is less than 60 degrees F (16 degrees C) or over 90 degrees F (32 degrees C).

1.08 WARRANTY

A. Provide manufacturer's standard written 10-year warranty, covering materials and labor for replacement of defective materials.

B. Provide Contractor's warranty that work will be free of defects in materials and workmanship for 5 years.

PART 2 PRODUCTS 2.01 GENERAL

A. FloorScore Compliance: Tile for floors shall comply with requirements of FloorScore Standard.

B. Low-Emitting Materials: Flooring systems shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers" or other LEED-approved standard for VOC content. C. See drawings for floor tile patterns.

D. Equal products will only be considered if substitutions are submitted and accepted by the architect prior to the bid.

2.02 TILE

A. Manufacturers: All products of each type by the same manufacturer.
   1. Tile selection shall be as indicated on drawings.
   2. The Architect reserves the right to select tile from any series listed when preparing color schedule. The tile contractor shall supply the selected tile at no additional cost to the Owner.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. **Porcelain Floor Tile Type PT-1 used in Lobby and where shown on drawings:** ANSI A137.1, and as follows:
   1. Terra Tones, manufactured by Mosa or approved equivalent product.
   2. Moisture Absorption: < 20.0 percent.
   3. Breaking Strength: >150 lbf
   4. Size and Shape: PT-1: 12” x 24”.
      See drawings for tile patterns and color layout.
   5. Edges: Square.
   6. Surface Finish: Matt

7. Colors: To be selected from full line of colors and shades (x,y,z), by Architect.
8. Trim Units: Matching bullnose, surface bullnose, cove base, and corner trim shapes in sizes coordinated with field tile. Base tile shall be Cove Base Trim. Size and color to be coordinated with wall tile above, where required.

2.03 TRIM AND ACCESSORIES

A. Ceramic Accessories: Same color and finish as adjacent field tile; same manufacturer as tile.

B. Porcelain Trim: Matching bullnose, cove base, cove, and corner trim ceramic shapes in sizes coordinated with field tile.
   1. Applications: Use in the following locations:
      a. Open Edges: Bullnose.
      b. Inside Corners: Jointed.
      c. Floor to Wall Joints: Cove base.
   2. Manufacturer: Same as for tile.

C. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications: Use in the following locations:
      a. Open edges of floor tile.
      b. Transition between floor finishes of different heights.
         1) Tile/Terrazzo Transition: Schulter Systems Reno-U or approved equal.
         2) Tile/Carpet Transition: Schulter Systems Reno-TK or approved equal.
      c. Expansion and control joints, floor and wall.
   2. Manufacturer:
      a. Schluter-Systems: www.schluter.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 MORTAR MATERIALS

A. Manufacturers:
   1. Basis of Design: Laticrete International, Inc.: www.laticrete.com. 2. Bonsal American, Inc: www.sakrete.com
   3. Bostik Inc: www.bostik-us.com.
   4. Custom Building Products: www.custombuildingproducts.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Mortar Bed Materials: Portland cement, sand, latex additive and water.

C. Mortar Bond Coat Materials:
   1. Latex-Portland Cement type: ANSI A118.4 and A118.11.
      a. Thin-Set: One-step polymer fortified, thin-set mortar. Use at small size tile on flat surfaces. Laticrete 254 Platinum or approved equal.
         1) Shear Bond, Porcelain Tile, 28 day cure - ANSI A118.4-1999; F-5.2.4: 500 psi (3.5 MPa).
         2) Shear Bond, Porcelain Tile, Water Immersion - ANSI A118.4-1999; F-5.2.3 340 psi (2.3 MPa).
         3) Water Absorption - ANSI A118.6-1999; H 4.4 4% max.
         4) Compressive Strength - ANSI A118.4-1999; F-6.1: 5000 psi (34.5 MPa)
         5) TCNA Service Rating - ASTM C-627: Extra Heavy
         6) Tensile Bond - S 5980:1980 Class AA; 14 days: 1575 N (355 lbs)
         7) Shear Adhesion - BS 5980:1980 Class AA; 14 days: 22.8 kN (5126 lbs) 8) Coefficient of Linear Thermal Expansion - ASTM C-531: 65x10-7 / Degrees F (117x10-7 / Degrees C) 9) Color: Gray.
      b. Medium Set: Polymer fortified dry-set mortar formulated for large-format tile. Mortar may be built up to 3/4". Use at large size tile and where necessary to allow for

proper fit to sloped floor drains. Laticrete 220 Marble and Granite Mortar with Laticrete 3701 Mortar Admix.

1) Compressive Strength: 5,000 psi (34.5 MPa), min. in accordance with ANSI A118.4.
2) Hardness: 70 to 80, in accordance with ASTM D 2240 D-scale for 72 hours.
3) Wet Density: 135 pcf (2166 kg/cu m), nominal, in accordance with ASTM C 905.
4) Water Absorption: 5 percent, max. in accordance with ANSI A118.6; 1999 H-4.4.
5) Surface Burning Characteristics: Flame spread and smoke developed indices of 0, in accordance with ASTM E 84, modified.
6) Color: Gray.
7) Color: White.

c. Thick-Bed Mortar: Polymer fortified blend made of factory-blended cement and aggregates and polymers requiring only the addition of water; weather, frost, and shock resistant. Laticrete 3701 Fortified Mortar Bed or approved equal.

1) Compressive Strength: 4,000 - 5,000 psi min., in accordance with ANSI A118.7.
2) Water Absorption: 5 percent, maximum, in accordance with ANSI A118.7.
3) Flexural Strength: 1100 - 1200 psi in accordance with ANSI A118.7.
4) Shrinkage: 0.05% in accordance with ASTM C157. 5) TCNA Service Rating: Extra Heavy.

2.05 GROUT MATERIALS

A. Manufacturers:
1. Basis of Design: Laticrete International, Inc.: www.laticrete.com. 2. Bonsal American, Inc: www.sakrete.com
3. Bostik Inc: www.bostik-us.com.
4. Custom Building Products: www.custombuildingproducts.com.
5. Substitutions: See Section 01-6000 - Product Requirements.

B. Epoxy Grout: ANSI A118.3, modified epoxy emulsion grout, color as selected from manufacturer's standard colors; use for all applications, except at kitchens and areas subject to harsh chemicals. Laticrete SpectraLOCK PRO Grout or approved equal.
1. Water cleanability: Up to 80 minutes.
2. Initial set: 2 hours.
3. Service strength: 24 hours.
4. Shrinkage: 0.25 percent.
5. Quarry/quarry bond strength: 1,000 psi (6.9 MPa) - Failure at tile.
6. Compressive strength 3,500 psi (24 MPa) - 7 days.
7. Tensile strength 1,100 psi (7.6 MPa) - 7 days.
8. Thermal shock 510 psi (3.5 MPa).
9. Water absorption: Less than 0.50 percent.
10. Color: As selected by Architect from manufacturer's full range.

C. Industrial Epoxy Grout: ANSI A118.3, Highly chemical resistant, industrial grade epoxy grout at kitchens and areas subject to harsh chemicals. 100 percent solids stain resistant, acid- and chemical-resistant, water cleanable. Laticrete SpectraLOCK 2000 IG or approved equal.
1. Compressive Strength: 10,000 psi (69 MPa), min., in accordance with ANSI A118.5.
2. Bond Strength: 620 psi (4.3 MPa), min., in accordance with ANSI A118.5.
3. Thermal Shock Resistance: Complies with ANSI A118.3.
4. Shrinkage and Sag Resistance: Complies with ANSI A118.5.
5. Initial Set and Service Set Time: Complies with ANSI A118.5.
6. Service Rating: Passing ASTM C 627 cycles 1-14 (TCNA "Extra Heavy").
7. Color: As selected by Architect from manufacturer's full range.

2.06 ACCESSORY MATERIALS

A. Cleavage Membrane: No. 15 asphalt saturated felt.

B. Waterproofing Membrane at Floors and Showers: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Material: Single component, self-curing, liquid rubber polymer that forms a flexible, seamless waterproofing membrane that does not require the use of fabric in the field, coves or corners. Membrane shall function as a load-bearing waterproofing membrane and a crack isolation membrane.
      a. TCNA Performance Level: Extra Heavy
      b. Membrane shall contain anti-microbial protection.
      c. 7 day hydrostatic test: Pass in accordance with ANSI A118.10
      d. 7 day tensile strength: 265-300 psi in accordance with ANSI A118.10
      e. 7 day water immersion: 95-120 psi in accordance with ANSI A118.10
      f. 7 day shear bond: 200-275 psi in accordance with ANSI A118.10
      g. 28 day shear strength: 214-343 psi in accordance with ANSI A118.10
      h. System crack resistance: Pass (high) in accordance with ANSI A118.12

C. Crack Suppression and Anti-Fracture Membrane: Thin, fabric reinforced fluid-applied rubber membrane with capability of bridging non-structural cracks. Laticrete Blue 92 Anti-Fracture Membrane or approved equal.
   1. Service Rating: Passing ASTM C 627 cycles 1-14 (TCNA "Extra Heavy").
   2. System Crack Resistance - ANSI A118.12 5.4: Pass at 1/8 inch (3 mm).
   3. Elongation - ASTM D751- 89 17.1: 20- 30%.
   4. Breaking Strength (Cut Strip Method) ASTM D751:1700- 1900 Psi (11.72- 13.10 MPa).
   5. Nominal Dry Thickness LIL 1013- 92 0.020 inch (0.51mm).
   6. 28 Day Shear Strength - ANSI A118.12 5.1.5: 125- 175 Psi (0.86- 1.6 MPa).
   7. Point Load - ANSI A118.12 5.2: 3200- 3700 lbf (14- 16 kN).

D. Reinforcing Mesh: 2 x 2 inch size weave of 16/16 wire size; welded fabric, galvanized.

E. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

F. Coated Glass Mat Backer Board: ASTM C 1178/C 1178M, with coated inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder. G. Mesh Tape: 2-inch wide selfadhesive fiberglass mesh tape.

H. Sealant: Single component neutral cure silicone sealant designed for exterior and interior applications for ceramic tile & stone applications.

PART 3 EXECUTION 3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

F. Do not proceed until the unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.

E. Install tile backer board in strict accordance with manufacturer's instructions, using galvanized roofing nails or corrosion-resistant bugle head drywall screws. Bed fiberglass self-adhesive tape at all joints and corners with material used to set tiles.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and The Tile Council of North America Handbook recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
   1. See drawings for tile patterns.
   2. Align joints when adjoining tiles on floor and base are the same size.
   3. Layout tile work and center tile fields both directions in each space or on each wall area. Adjust to minimize tile cutting.
   4. Provide uniform 1/8” joint widths for tiles up to 8” x 8” and 1/4” joints at larger tiles, unless otherwise shown.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout. E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Provide all transition pieces, trim, corners and ends as required to achieve a neat, finished project.

H. Install non-ceramic trim in accordance with manufacturer's instructions.

I. Sound tile after setting. Replace hollow sounding units.

J. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

K. Allow tile to set for a minimum of 48 hours prior to grouting.

L. Grout tile joints. Use standard grout unless otherwise indicated.

M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET AND MEDIUM-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA Handbook Method F113, dryset or latex-portland cement bond coat, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, install in accordance with The Tile Council of North America Handbook Method F122, with latex-Portland cement grout.
   2. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with The Tile Council of North America Handbook Method F115.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with The Tile Council of North America Handbook Method F111, with cleavage membrane, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with The Tile Council of North America Handbook Method F121.
   2. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with The Tile Council of North America Handbook Method F114, with waterproofing membrane.

B. Cleavage Membrane: Lap edges and ends.

C. Waterproofing Membrane: Install as specified in ANSI A108.13.

D. Mortar Bed Thickness: 1-1/4 inch, unless otherwise indicated.

3.07 TILE ACCESSORIES:

A. Apply control joint profiles at control joints in slab where indicated. Control joint locations shall be approved by Architect. Provide anti-fracture membrane at all control joints in new and existing slabs and where new slabs abut existing slabs. Anti-fracture membrane shall extend 6" to each side of control joint. Prime substrate and install in accordance with manufacturer's recommendations.

3.08 EXPANSION JOINTS:

A. Provide horizontal and vertical expansion joints per TCNA EJ171 as follows:
   1. At the perimeter of all spaces 8'-0" x 8'-0" and larger.
   2. At interior spaces not to exceed 20'-0" x 20'-0" in either direction.
   3. Verify expansion joint locations with the Architect prior to installation.

3.09 CLEANING

A. Clean tile and grout surfaces. Remove all grout haze, observing tile manufacturer's recommendations as to use of acid and chemical cleaners. Rinse tile work thoroughly with clean water before and after using chemical cleaners.

3.10 PROTECTION

A. Protect tile in accordance with TCNA recommendations.

B. Do not permit traffic over finished floor surface for 4 days after installation.

C. Place large, flat boards in walkways and wheelways for 7 days, where use of newly tiled floor is unavoidable.

D. Walls: Protect from impact, vibration and heavy hammering on adjacent and opposite walls for at least 14 days after installation, unless manufacturer's instructions allow a shorter period.

E. Protect from food products and chemicals which can cause staining until acceptance by the Owner.

F. Protect from freezing and total water immersion for at least 21 days after installation.

G. Apply to all clean, completed tile floors a protective coat of neutral cleaner solution, 1 part cleaner to 1 part water. In addition cover all tile floors with heavy-duty, non-staining construction paper, masked in place. Just before final acceptance of tile work, remove paper and rinse protective coat of neutral cleaner from all tile surfaces.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Glass-Mat Faced Backing Board.

G. Gypsum wallboard.

H. Joint treatment and accessories.

I. Water-resistive barrier over exterior wall sheathing.

1.02 RELATED REQUIREMENTS:

A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 07 2100 - Thermal Insulation: Acoustic insulation.

C. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire rated walls.

D. Section 07 9005 - Joint Sealers:

E. Section 09 5100 - Acoustical Ceilings: Gypsum board soffits at acoustical ceilings.

1.03 REFERENCE STANDARDS:

A. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 1999 (R2005).

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (R2005).

C. ASTM C 475/C 475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002 (Reapproved 2007).

D. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members; 2009a.

E. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2009a.

F. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; 2008.

G. ASTM C 954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2007.

H. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.

I. ASTM C 1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2009.

J. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2008.

K. ASTM C 1280 - Standard Specification for Application of Gypsum Sheathing; 2009.

L. ASTM C 1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets; 2008b.

M. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board; 2009a.

N. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000 (Reapproved 2005).

O. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2005.

P. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

Q. ASTM E 413 - Classification for Rating Sound Insulation; 2004.

R. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2007.

S. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.

T. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS:

A. See Section 01-3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Test Reports: For all stud framing products that do not comply with ASTM C 645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.05 ENVIRONMENTAL REQUIREMENTS:

A. Do not install joint treatment compounds unless installation areas comply with the temperature and ventilation requirements recommended by the drywall manufacturer.

1.06 QUALITY ASSURANCE:

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 5 years of documented experience.

1.07 DELIVERY AND STORAGE OF MATERIALS:

A. Coordinate delivery with construction schedule to minimize storage periods at the project site. Deliver in manufacturer's unopened bundles or packages, fully identified with manufacturer's name, brand, type and grade. Protect from weather, soiling and damage using handling equipment and storage techniques recommended by manufacturer.

B. ALL GYPSUM WALLBOARD AND INSULATION SHALL BE KEPT DRY. ANY WALLBOARD OR INSULATION THAT GETS WET IN STORAGE OR AFTER INSTALLATION SHALL BE REMOVED AND REPLACED. ALL PRODUCTS SHOWING EVIDENCE OF MOLD GROWTH SHALL BE DISCARDED. PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS:

A. LEED Requirements: Were all other criteria are met, Contractor shall give preference to products that contribute to LEED objectives such as:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project, such as American Gypsum.
   2. Have a longer documented life span under normal use.
   3. Result in less construction waste
   4. Contain recycled content
   5. Contribute to indoor air quality, such as Certainteed AirRenew gypsum board.

B. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.02 GYPSUM BOARD ASSEMBLIES:

A. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

B. Provide completed assemblies complying with ASTM C 840 and GA-216.

C. Interior Partitions at all interior metal stud walls: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 or higher when indicated, calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

D. Fire Rated Assemblies: Provide completed assemblies in compliance with tested assembly.
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory.

2.03 METAL FRAMING MATERIALS:

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
   1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
   2. Studs: "C" shaped with flat or formed webs, 20 gauge.
   3. Runners: U shaped, sized to match studs.
   4. Ceiling Channels: C shaped, 16 gauge.
   5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission. Shape to achieve STC assembly indicated.

C. Ceiling Hangers: Type and size as specified in ASTM C 754 for spacing required.

D. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short.

E. Gypsum Drywall Suspension System: USG Suspension System for flat gypsum panel ceilings. Pre-engineered, ASTM C645, G40 (G90 severe environmental conditions) hot-dipped galvanized system meeting all seismic and sound requirements of this project. Installation must follow IBC and ICC-ESR-1222

2.04 BOARD MATERIALS:

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Georgia-Pacific Gypsum LLC: www.gp.com/gypsum.
   4. National Gypsum Company: www.nationalgypsum.com.
   5. Temple-Inland Inc : www.templeinland.com.
   6. USG Corporation: www.usg.com.
   7. Substitutions: See Section 01-6000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
      a. Mold-resistant board is required at all locations.
   3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.

C. Abuse-Resistant Wallboard: Shall be 5/8" Fiber Rock brand VH1 panels by USG. Comply with ASTM E-119, ASTM E-84 and ASTM D4977.
   1. For all exposed drywall wall surfaces below 8 feet above the finished floor (except for administration areas not exposed to students or public use), provide abusive resistant gypsum wallboard with paper-face surface suitable for receiving decorator finish and with long edges tapered or radial eased to receive manufacturer's standard joint.

D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
   1. Core: 5/8 inch (15.9 mm), Type X.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D 3273, score of 10.

E. Backing Board for Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas including shower ceilings and behind hard tile.

      For all exposed shower drywall ceiling surfaces, provide 1/2" thick panels surface suitable for receiving skim coat of Durabond setting compound. Skim-coat the entire surface to a Level 5 finish. Tape with fiberglass mesh and finish all joints smooth. Finished surface is to receive one coat epoxy primer and two coats of epoxy paint.

   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
   3. Glass-Mat-Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C 1178.
      a. Standard Type: Thickness 1/2 inch.
      b. Products:
         1) Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
         2) Temple-Inland Inc; GreenGlass Tile Backer.
         3) Substitutions: See Section 01-6000 - Product Requirements.

D. Backing Board for Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C 1396/C 1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thin set tile, except in wet areas.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
   3. Type: Regular and Type X, in locations indicated.
   4. Type X Thickness: 5/8 inch.
   5. Regular Board Thickness: 5/8 inch.
   6. Edges: Tapered.

E. Ceiling Board: Special sag-resistant gypsum ceiling board as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: 5/8 inch.
   3. Edges: Tapered.

F. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
   1. Application: Exterior sheathing, unless otherwise indicated.
   2. Glass-Mat-Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C 1177/C 1177M.
   3. Unfaced Sheathing: Water-resistant exterior fiber-reinforced gypsum sheathing panels as defined in ASTM C 1278/C 1278M, and exceeding the relevant requirements of ASTM C 1177/C 1177M.
   4. Core Type: Regular.
   5. Regular Board Thickness: 5/8 inch.
   6. Edges: Square, for vertical application.
   7. Glass-Mat-Faced Products:
      a. CertainTeed Corporation; GlasRoc Brand.
      b. Georgia-Pacific Gypsum LLC; DensGlass Gold Sheathing.
      c. National Gypsum Company; Gold Bond Brand e2XP Extended Exposure Sheathing.
      d. Temple-Inland Inc; GreenGlass Exterior Sheathing.
      e. Substitutions: See Section 01-6000 - Product Requirements.
   8. Unfaced Products:
      a. USG Fiberock Brand Aqua-Tough Sheathing Panels.

2.05 ACCESSORIES:

A. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   1. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool. See section 07 2100 “Thermal Insulation” for additional acoustical insulation products and information.

C. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Acoustical sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
   2. Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

D. Finishing Accessories: ASTM C 1047, galvanized steel or rolled zinc, unless otherwise indicated.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.

E. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2-inch-wide, creased paper tape for joints and corners, except as otherwise indicated.
   2. Ready-mixed vinyl-based joint compound.
   3. Chemical hardening type compound.

F. Screws for Attachment to Steel Members Less Than 0.03 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

G. Screws for Attachment to Steel Members From 0.033 to 0.112 Inch in Thickness: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.

H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION:

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION:

A. Metal Framing: Install in accordance with ASTM C 754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center unless other noted.
   1. Level ceiling system to a tolerance of 1/1200.
   2. Laterally brace entire suspension system.

C. Studs: Space studs as indicated.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install mechanically fastened steel channel blocking for support of:
   1. Wall mounted cabinets.
   2. Plumbing fixtures.
   3. Toilet partitions.
   4. Toilet accessories.
   5. Wall mounted door hardware.
   6. Markerboards
   7. Other wall-mounted fixtures and equipment 3.03 ACOUSTIC ACCESSORIES INSTALLATION:

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
   1. Batts may be friction-fit in place unless insulation does not fill the cavity depth, then supplementary support must be provided to hold product in place.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

3.04 BOARD INSTALLATION:

A. Comply with ASTM C 840. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exterior Sheathing: Comply with ASTM C 1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Tape-seal joints immediately after installation in accordance with manufacturer's recommendations. Use fiberglass joint tape provided by same manufacturer as sheathing.

E. Glass-Mat Faced Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions. Use glassmat faced backing board as substrate behind ceramic wall tile at metal stud wall conditions unless otherwise noted.

F. Installation on Metal Framing: Use screws for attachment of all gypsum board.

G. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

H. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

3.05 ISOLATION OF DRYWALL FROM OTHER CONSTRUCTION:

A. Provide Perimeter Relief where non-load-bearing drywall partitions abut structural decks or ceilings or vertical structural elements. Allow not less than 1/4", nor more than 1/2" gap between gypsum drywall and structure. Finish edges of drywall face layer with square-nose metal casing bead and caulk space between casing bead and structure with continuous sealant bead. Attach drywall to studs not less than 1/2" below bottom edge of ceiling track flanges and to first stud adjacent to vertical tracks. Do not attach drywall directly to tracks.

B. Where Drywall Partitions Intersect Masonry Walls, provide control joint not less than 1/4", nor more than 3/8" wide between gypsum wallboard and masonry. Finish the exposed edges of gypsum board with square nose metal casing bead and caulk space between casing bead and masonry with continuous sealant bead. Caulking of the joint will be at the architect’s discretion depending on craftsmanship of the condition. It is preferred that the joint not be caulked

3.06 INSTALLATION OF TRIM AND ACCESSORIES:

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   2. At exterior soffits, not more than 30 feet apart in both directions.
   3. Where ceilings and soffits are greater than 30' runs and do not exceed 12' in width.
   4. Where ceilings or wall areas exceed 300 sq. ft.
   5. At the strike side of doors extending from the top of door frame to 8" above ceiling.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.07 JOINT TREATMENT:

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C 840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 2: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

As a minimum, Level 4 finishing shall be required for this project where GWB is exposed to view. In areas not exposed to view, provide as a minimum Level 2 finishing procedures.

3.08 TOLERANCES:

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

GENERAL

1.1 SUMMARY

A. This Section includes acoustical tiles and concealed suspension systems for ceilings.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: Drawn to scale and coordinating acoustical tile ceiling installation with hanger attachment to building structure and ceiling mounted items. Show size and location of initial access modules.

C. Samples: For each exposed finish.

D. Product test reports.

E. Research/evaluation reports.

F. Maintenance data.

G. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

1.3 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAPaccredited laboratory.

B. Fire - Test-Response Characteristics:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Acoustical tiles complying with ASTM E 1264 for **Class A** materials, when tested per ASTM E 84.

a. Smoke-Developed Index: 450 or less.

C. Seismic Standard: Comply with the following:

3. Ceilings shall be installed using Seismic Design Category “C” guidelines.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size tiles equal to 0.5 percent of quantity installed.

4. Suspension System Components: Quantity of each concealed grid and exposed component equal to .05 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL TILE CEILINGS, GENERAL

A. Acoustical Tile Standard: Comply with ASTM E 1264.

1. Recycled Content: Provide acoustical tiles with recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content constitutes a minimum of 48 percent by weight.

B. Metal Suspension System Standard: Comply with ASTM C 635.

1. Recycled Content: Provide products made from steel sheet with average recycled content such that postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 3 percent.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to **10** times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69mm-) diameter wire. E. Seismic struts and seismic clips.

F. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.2 ACOUSTICAL TILES FOR ACOUSTICAL TILE CEILING

A. ACT-1: Provide USG (High CAX and NRC) 2 x 2 tile #86346 SLT with minimum of .80 NRC and minimum of 40 CAC (35 CAC NOT Acceptable). Submittals for approval of substitutions must be received at least 10 days prior to bid date and approved by Addendum. Use Donn DX

26 HD Grid and Donn MS 174 Option 2 Wall Molding. NOTE: Heavy Duty Grid is required on this Seismic Design Category ‘C’ project.

EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 636, ASTM E580/E 580M and seismic design requirements indicated, per manufacturer's written instructions, along with the ceiling system manufacturer's IBC approved test and evaluation reports. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders.

B. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
2. Do not attach hangers to steel deck tabs or to steel roof deck.

C. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

END OF SECTION 09 5123

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes:

1. Metal ceiling panels.
2. Suspension system.
3. Wire hangers, clips, wall angle moldings and accessories. B. Related Sections:

1. Section 09 5100 - Acoustical Ceilings
2. Section 09 2116 - Gypsum Board Assemblies
3. Division 23 - Heating, Ventilating, and Air Conditioning
4. Division 26 - Electrical Work

C. Alternates

1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than twenty-five (25) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products which have not been approved by Addenda, the specified products shall be provided without additional compensation.
   a. Roll formed, pre-painted steel is not an acceptable substitute.
2. Submittals which do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); panel design, size, composition, color, and finish; suspension system component profiles and sizes; compliance with the referenced standards. **1.3 REFERENCES**

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the HotDip Process
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels
7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

9. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
10. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems

11. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
12. ASTM E 1264 Classification for Acoustical Ceiling Products

B. International Building Code
C. ASHRAE Standard 62.1-2004, "Ventilation for Acceptable Indoor Air Quality"
D. NFPA 70 National Electrical Code
E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures
F. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components
G. International Code Council-Evaluation Services Report – Seismic Engineer Report
   1. ESR 1308 – Armstrong Suspension Systems
H. International Association of Plumbing and Mechanical Officials – Seismic Engineer Report
   1. 0244 – Armstrong Single Span Suspension System
I. California Department of Public Health CDPH/EHLB Emission Standard Method Version 1.1 2010
J. LEED - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for each type of ceiling unit and suspension system required.
B. Samples: Minimum 6-inch x 6-inch samples of specified metal panel; 8 inch long samples of suspension system if applicable.
C. Installation Instructions: Submit manufacturer's installation instructions as referenced in Part 3, Installation.
D. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
E. If the material supplied by the acoustical subcontractor does not have a Factory Mutual classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide metal ceiling and suspension components produced by a single manufacturer with resources adequate to deliver a product of consistent quality in terms of appearance and physical properties for all project scopes without risk of delay or interruption.
B. Fire Performance Characteristics: Identify ceiling components with appropriate applicable, testing, including:
   1. Surface Burning Characteristics: As follows, tested per ASTM E84:
      a. Flame Spread: 25 or less
C. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver system components in manufacturer's original, unopened packages clearly labeled with the following information: item number and quantity, manufacturer's name and address, client name and address and site address.
B. Store components in a fully enclosed dry space where they will be protected against damage from moisture, direct sunlight, surface contamination and other construction activities.

C. Exercise care in handling components to prevent damage to the surfaces and edges and prevent distortion or other physical damage.

1.7 PROJECT CONDITIONS

A. Space Enclosure:

1. Building areas to receive ceilings shall be free of construction dust and debris. Products may be installed where temperatures are between 32°F (0°C) and 120°F (49°C) and in spaces before the building is enclosed, where HVAC systems are cycled or not operating. Such installations shall not be exposed to abnormal conditions, namely: chemical fumes, presence of standing water, or contact with moisture, as could result from condensations or building leaks. These products cannot be used in exterior applications unless the system has been specifically designed and approved for exterior application.

1.8 WARRANTY

A. Ceiling System: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:

1. Ceiling Panels and Suspension System: Rust and manufacturing defects. B. Warranty Period:

1. One (1) year from date of substantial completion.
2. Grid: Ten (10) years from date of substantial completion.

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.

1. Ceiling Units: Furnish quantity of full-size units equal to 2 percent of amount installed.
2. Suspension System Components: Furnish quantity of each exposed suspension component equal to 1 percent of amount installed. B. Deliver extra stock to Owner's representative.

2.1 MANUFACTURERS

A. Ceiling Panels:

1. Armstrong World Industries, Inc. (Solutions Center, Bill Commella 717.396.4638)

B. Suspension Systems:

1. Armstrong World Industries, Inc. (Solutions Center, Bill Commella 717.396.4638)

2.2.0 METAL CEILINGS PLANKS

A. Ceiling Panels Type AMP-1: (To be determined)

1. Surface Texture: Smooth
2. Composition: Aluminum
3. Perforations: (Non-perforated) (Standard perforations) 4. Finish: (Effects Wood look) to be Selected.
5. Colors: (Effects Maple) (Effects Cherry) (Effects Dark Cherry) (Effects Walnut) (Effects Oak) (Effects Walnut Expresso)
6. Size: (custom sizes) Radial per Architectural drawings.

7. Edge Profile: Butt Edge (Reveal and Center Scoring options available) 8. Noise Reduction Coefficient (NRC): (up to 0.90 with fiberglass infill panels.
9. Flame Spread: ASTM E 1264; Class A per IBC.
10. Acceptable Product: MetalWorks Torsion Spring, Item # (DS18608) as manufactured by Armstrong World Industries.

2.2.1 SUSPENSION SYSTEMS

A. Components: extruded Aluminum
1. Pre-Slotted Main Beam: Extruded Aluminum
2. Pre-Slotted Cross Tees: Extruded Aluminum 3. Cross Tees: Extruded Aluminum 4. Accessories:
   a. Box Molding Item # (7125___)
   b. Extruded Perimeter Trim Item# (7147___)
   c. Formed Perimeter Trim Item # (7131___)
   d. Spreader Hold Down Item # (7126)
   e. Torsion Spring Hook Access Tool Item # (7129)
   f. Torsion Spring Suction Access Tool Item # (7130)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer must inspect the area where the ceiling system is to be installed for conditions that may affect the work and notify the Contractor in writing of any unsatisfactory conditions before proceeding.
B. All work above the ceiling system is to be satisfactorily completed prior to start of the ceiling installation.
C. All unsatisfactory conditions potentially affecting the ceiling system are to be corrected prior to the start of ceiling installation.
D. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.

3.2 PREPARATION

A. Examine construction and conditions under which system will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install the suspended ceiling system in accordance with the manufacturer's installation instructions, applicable industry standards, and the governing code of jurisdiction.
   1. MetalWorks Torsion Spring Installation (contact 877-276-7876 option 1,1,4 for assistance).
B. Installed panels should be free from damaged edges or other defects detrimental to appearance and function.

3.4 FIELD QUALITY CONTROL

A. Deflection of any grid components shall not exceed 1/360 of the span.

3.5 ADJUSTING AND CLEANING

Adjust ceiling components to provide a consistent finish and appearance in conformity with preestablished tolerances and requirements. All panels showing signs of damage, either in finish or in form are to be replaced. All exposed surfaces are to be cleaned of any dirt, grease, fingerprints and marks or other imperfections with cleaning materials recommended by the manufacturer.

END OF SECTION

SECTION 09 6610 GREENWOOD SCHOOL DISTRICT 50

RUBBER FLOORING ACCESSORIES 1.0 GENERAL

1.1 SCOPE: This section covers rubber flooring accessories complete. The extent of work is as Shown on drawings and in schedules or if not shown as required at termination of carpet and resilient flooring edges or transitions as required.

1.2 RELATED DOCUMENTS:

A. Drawings and General Provisions of contract, including general and supplementary conditions and Division 1 Specification Sections, apply to work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturer: Provide each type of rubber flooring and accessories as produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds. All products shall be 100% asbestos free.

B. Products as manufactured by one of the following and chosen by the Architect depending on color selections.
1. Roppe Corporation
2. Johnsonite

1.4SUBMITTALS:

A. Product Data:Submit two copies of manufacturer's technical data and installation instructions for each type of rubber accessory.

B. Samples: Submit two sets of samples of each type, color and finish of flooring and accessory required. Provide full-size tile units and 6" long sample of accessory. Include full range of flooring color and pattern variation. Sample submittals will be for reviewed for color, texture and pattern only. Compliance with all other requirements is exclusive responsibility of Contractor.

C. Replacement Material:After completion of work, deliver to project site replacement materials from same manufactured lot as materials installed, not less than one box for each 50 boxes or fraction thereof, for each type, size and color installed.

1.5 JOB CONDITIONS:

A. Maintain minimum temperature of 65 degrees F (18 degrees C) in spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Store flooring materials in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 55 degrees F (13 degrees C) in areas where work is completed.

B. Install rubber flooring and accessories after other finishing operations, including painting, have been completed. Do not install resilient flooring over concrete slabs until the latter have been cured and are sufficiently dry to achieve bond with adhesive as determined by manufacturer's recommended bond and moisture test.

2.0 PRODUCTS:

2.1 RUBBER MATERIALS:

A. Flooring Accessories: As shown in the finish schedule or listed herein as Cove Base or Wall Base shall be 1/8" TYPE TS THERMOSET VULCANIZED RUBBER COVE BASE. It shall be constructed of first-quality materials properly vulcanized and shall be smooth and free from imperfections which distract from its appearance. The base shall conform fully to the requirements of ASTM F-1861 Type TS (Thermoset Vulcanized Rubber).

All Cove Base shall be Standard Toe Base 5/8" with a height of 4" (unless otherwise indicated on Finish Schedule), available in lengths of 48" and 120" with a thickness of 1/8". Provide pre molded inside corner units as noted on finish schedule. Color shall be selected by Architect equally priced to Pinnacle Series by Roppe.

B. Rubber Accessories: Shall be constructed of first quality materials properly vulcanized and shall be smooth and free from imperfections which distract from its appearance. These accessories hall conform full to the requirements of federal specifications SSW40A Type 1 rubber. Accessories shall include: Reducer strips, glue down carpet edges, carpet edge guards, custom carpet edging, reducer strips, tile/carpet jointers, and other shapes as required, unless otherwise stated in drawings. Sizes shall be as required. Colors shall be selected by the Architect equally priced to Burgundy by Roppe.

C. Adhesives (Cements): Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions.

D. Concrete Slab Primer: Non-staining type as recommended by flooring manufacture.

E. Leveling Compound: Type as recommended by manufacturer.

3.0 EXECUTION:

3.1 PREPARATION:

A. Concrete Subfloors: Remove any existing resilient tile flooring and condition subfloors to provide smooth, clean, continuous surface. Use underlayment where required to provide level surfaces read to receive tile. Fill holes and cracks in the concrete subfloors with crack filler. Remove grease, dirt, loose particles, and other foreign matter that would prevent adhesion. Then rinse subfloors and allow to dry thoroughly before applying adhesive.

B. Moisture Test: After concrete floor surfaces have been cleaned, small patches of adhesive to be used shall be spread in several locations in each room and allowed to dry overnight. If the adhesive can be peeled easily from the floor surface, the floor is not sufficiently dry. The test shall be repeated until the adhesive adheres properly. When the adhesive adheres tightly to the floor surface, the resilient flooring shall be applied.

C. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

1. Rubber Base: Remove any surface film on back of base due to mold release agents as recommended by base manufacturer, before applying base adhesive.

Provide performed molded internal and external corners and end stops. Wherever rubber base is used in conjunction with vinyl wall covering, spread adhesive to within 1/4" below top of base. Immediately remove spots or smears of adhesive from exposed surface.

2. Rubber Stair Treads: The tread and adhesive should be brought to room temperature, no less than 60 degrees F (16C), for 48 hours before, during, and after installation. In winter, materials should be brought to room temperature, no less than 60 degrees (16C) for 72 hours prior to installation. Stair treads and landings shall be installed in accordance with manufacturer's recommendations. Apply in one-piece, trim to fit.

3. Rubber Accessories: Shall be installed in accordance with manufacturer's recommendation. Immediately remove spots or smears adhesive as installation proceeds.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Concrete – No painting required.
2. Concrete masonry units (CMU).
3. Steel.
4. Steel - Exposed surfaces of steel lintels and ledge angles.
5. Steel – Hollow Metal Doors and Frames.
6. Galvanized metal.

B. Scope: Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Labels - equipment serial number and capacity labels, and operating parts of equipment.
5. Non-metallic roofing and flashing.
6. Stainless steel, chrome, copper, bronze, and anodized aluminum and similar finished materials.
7. Factory-finished metal work.
8. Marble, granite, slate, and other natural stones.
9. Ceramic and other tiles.
10. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
11. Brick and integrally colored block.
12. Glass.
13. Concealed pipes, ducts, and conduits.

RELATED WORK SPECIFIED IN OTHER SECTIONS:
The following categories of work are not included as part of the painter-applied finish work or are included in other sections of the specifications except as otherwise shown on drawings or specified herein.

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal items, hollow metal work and shop-fabricated or factory built metal mechanical and electrical equipment or accessories.

2. Pre-Finish Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) metal toilet enclosures, acoustic materials, architectural woodwork and casework, finished mechanical

and electrical equipment including light fixtures, switches, gear and distribution cabinets. Mechanical equipment that does not have finish paint will be painted under this section.

3. Concealed Surfaces: Unless otherwise indicated, painting is not required on wall or ceiling surfaces in concealed areas and inaccessible areas, such as foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts, and elevator shafts, as applicable to this project. Paint all piping, equipment and other items in these spaces as required.

4. Finish Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials shall not be painted, except as otherwise specified.

5. Operating Parts and Labels: Do not paint any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts, unless otherwise indicated. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

6. Colors: Paint colors will be as selected by the Architect and before any painting is done the Architect will furnish the Contractor with the selected color chips and schedule showing where the various colors will be applied. Finish colors shall exactly match the color chips. There will be a minimum of 14 colors used in this project. Color changes will be made at accent walls in rooms, door frames to walls, soffits in ceilings, breaks in walls, flutes in columns, column details at bases, column detail at capitols and at other breaks, changes in planes and elsewhere as deemed necessary by the Architect.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each finish and for each color and texture required.

C. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.3 LIST OF PROPOSED MATERIALS

A. List of Proposed Materials: Verify, in writing, that products proposed are from products listed herein. This submittal shall include full identifying product names and catalog numbers. Materials for prime coats, undercoats, finish coats and thinning applied to same surface shall be produced by the same manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.
C. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

D. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.5 DELIVERY AND STORAGE

A. Deliver materials to job in original containers with labels intact and seals unbroken.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Store materials and painter’s tools in a single room assigned for this use only. Keep storage place clean and neat and damage to it shall be corrected.

E. Keep paint and other volatile material tightly covered at all times when not in actual use.

F. Remove soiled and oily rags and waste from building every night and take every precaution to prevent spontaneous combustion.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Coatings: 1 gallon of each color and type; store where directed.
3. Label each container with color and finish color schedule designation in addition to the manufacturer's label.

1.7 JOB, WEATHER, AND TEMPERATURE CONDITIONS

A. Exterior painting: Do no exterior painting when temperature is below 50 degrees F., while surface is damp or during cold, foggy, rainy or frosty weather or when temperature is

likely to drop to freezing within 24 hours. Avoid painting surfaces while they are exposed to hot sun. Allow 48 hours drying after rain before commencing painting.

1.8 COOPERATION WITH OTHER TRADES: Schedule this work and coordinate it with other trades and do not proceed until other work and/or job conditions are as required to achieve satisfactory results. Examine drawings and specifications for the work of various other trades and become familiar with all their provisions regarding painting. Surfaces that are left unfinished by requirement of other sections shall be painted or finished as part of the work covered by this section.

1.9 INSPECTION OF SURFACES:

A. Examine surfaces to receive paint finishes, in accord with Contract Conditions, for defects which cannot be corrected by procedures specified herein under "Preparation of Surfaces" and which might prevent satisfactory painting results. Do not proceed with work until such defects are corrected. Commencing of work constitutes acceptance of surfaces and thereafter, Contractor shall be responsible for satisfactory results as required herein.

B. Painting of Previously Painted Surfaces: The painter shall determine paint compatibility with specified products and surfaces previously painted. Should paints be noncompatible, notify the architect. Otherwise, lightly sand or treat surfaces as recommended by the manufacturer prior to installation of paint.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated. B. Colors: As selected by Architect from manufacturer's full range.

C. Paints: The following manufacturers are acceptable provided that their products are equivalent or better in quality, appearance, sheen, durability and VOC content to specified system.
   1. Sherwin-Williams: www.sherwin-williams.com.
   2. PPG Architectural Finishes, Inc: www.ppgaf.com.
   3. Rose Talbert Paints: www.rosetalbert.com.
   4. Duron Paints: www.duron.com.

D. Flammability: Comply with applicable code for surface burning characteristics.

E. Colors: As selected by Architect from manufacturer's full range.
   1. Selection to be made by Architect after award of contract.

2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 PREPARATION AND APPLICATION CLEANING: The Painting Contractor will not only protect his work at all times, but will also protect all adjacent work and materials by suitable covering or other method during the progress of his work. Upon completion of the work, he is to remove all paint and varnish spots from the premises, all rubbish and accumulated materials and he is to leave the work in a clean, orderly and acceptable conditions.

3.4 EXTERIOR PAINTING SCHEDULE-Sherwin-Williams Basis of

Design **A. CMU Substrates:**

1. Latex System:

   a. Prime Coat: S-W Loxon Block Surfacer A24W200

   b. Intermediate Coat: S-W A-100 Exterior Latex Satin, A82-100 Series (4 mils wet, 1.5 mils dry per coat)

   c. Topcoat: S-W A-100® S-W A-100 Exterior Latex Satin, A82-100 Series (4 mils wet, 1.5 mils dry per coat)

B. Steel Substrates:

1. Water-based Acrylic System – Heavy Duty Performance:

   a. Full Prime: S-W Pro Industrial Pro-Cryl Universal Primer B66W310
   b. Intermediate Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel B531050 Series (gloss).
   c. Topcoat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel B53-1050 Series (gloss).

C. Galvanized-Metal Substrates:

1. Latex Over Water-Based Primer System:

a. Make sure to properly prep the galvanized metal before before priming. Remove all debris and contamination. Use heavy duty detergent to remove any oils or packing compounds. Rinse with clear water and allow it to dry overnight. It is vital that a full wet coat of 6-10 wt mils be applied to result in dry film thickness of 3-4 mils d.f.t. Apply one Full Prime Coat of Full Prime: S-W Pro Industrial Pro-Cryl Universal Primer B66W310
b. Intermediate Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel B531050 Series (gloss).
c. Topcoat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel B53-1050 Series (gloss).

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete
2. Concrete masonry units (CMU).
3. Steel.
4. Galvanized metal.
5. Wood.
6. Gypsum board.
7. Cotton or canvas insulation covering.

B. Field application of paints, stains, varnishes, and other coatings.

C. Materials for back-priming woodwork.

D. Scope: Finish all interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. All new work and existing surfaces where construction operations damage existing finish.
2. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
3. Elevator pit ladders.
4. Interior Ladders & Cages
5. Exposed surfaces of steel lintels and ledge angles.
6. Surfaces inside cabinets specified to be field finished.
7. Prime surfaces to receive wall coverings.
8. Backsides of access panels and removable or hinged covers shall be painted to match exposed surfaces.
9. Mechanical and Electrical:
    a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, and hangers, brackets, collars and supports, unless otherwise indicated. Finish shall match adjacent surface.
    b. In finished areas, paint shop-primed items.
    c. On the roof and outdoors, paint all equipment that is exposed to weather or to view, except that which is factory-finished.
    d. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    e. Paint dampers exposed behind louvers, grilles, to match face panels.
    f. Paint closets, areas behind cases, shelving and equipment. E. Scope: Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished. a. Wood doors are factory pre-finished.

2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Non-metallic roofing and flashing.
6. Stainless steel, chrome, copper, bronze, and anodized aluminum and similar finished materials.
7. Factory-finished metal work.
8. Marble, granite, slate, and other natural stones.
9. Floors, unless specifically so indicated.
10. Ceramic and other tiles.
11. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
12. Brick and integrally colored block.
13. Glass.
14. Acoustical materials, unless specifically so indicated.
15. Concealed pipes, ducts, and conduits.

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS:

The following categories of work are not included as part of the painter-applied finish work or are included in other sections of the specifications except as otherwise shown on drawings or specified herein.

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various sections for structural steel, miscellaneous metal items, hollow metal work and shop-fabricated or factory built metal mechanical and electrical equipment or accessories.

2. Pre-Finish Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) metal toilet enclosures, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment including light fixtures, switches, gear and distribution cabinets. Mechanical equipment that does not have finish paint will be painted under this section.

3. Concealed Surfaces: Unless otherwise indicated, painting is not required on wall or ceiling surfaces in concealed areas and inaccessible areas, such as foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts, and elevator shafts, as applicable to this project. Paint all piping, equipment and other items in these spaces as required.

4. Finish Metal Surfaces: Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials shall not be painted, except as otherwise specified.
5. Operating Parts and Labels: Do not paint any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts, unless otherwise indicated. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

6. Colors: Paint colors will be as selected by the Architect. Before any painting is done the Architect will furnish the Contractor with the selected color chips and schedule showing where the various colors will be applied. Finish colors shall exactly match the color chips. There will be a minimum of 14 colors used in this project. Color changes will be made at accent walls in rooms, door frames to walls, soffits in ceilings, breaks in walls, flutes in columns, column details at bases, column detail at capitols and at other breaks, changes in planes and elsewhere as deemed necessary by the Architect.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each finish and for each color and texture required.

C. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.4 LIST OF PROPOSED MATERIALS

A. List of Proposed Materials: Verify, in writing, that products proposed are from products listed herein. This submittal shall include full identifying product names and catalog numbers. Materials for prime coats, undercoats, finish coats and thinning applied to same surface shall be produced by the same manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

C. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

D. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
   a. Vertical and Horizontal Surfaces: Provide Color Card samples of at least 100 sq. ft. (9 sq. m).
   b. Once the color(s) have been selected for the color cards, the contractor shall provide a 2 ft. x 4 ft. mockup for each color at locations directed by the architect.

   c. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.6 DELIVERY AND STORAGE

A. Deliver materials to job in original containers with labels intact and seals unbroken.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Store materials and painter’s tools in a single room assigned for this use only. Keep storage place clean and neat and damage to it shall be corrected.

E. Keep paint and other volatile material tightly covered at all times when not in actual use.

F. Remove soiled and oily rags and waste from building every night and take every precaution to prevent spontaneous combustion.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Coatings: 1 gallon of each color and type; store where directed.
3. Label each container with color and finish color schedule designation in addition to the manufacturer's label.

1.8 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Interior Painting: Once painting has commenced, provide constant temperature of 65 degrees F. or above, and prevent wide variations in temperature which might result in condensation on freshly painted surfaces.

G. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

H. Protection of Other Work: Painting Contractor shall furnish drop cloths and lay cloths in areas where painting is being done to protect floors and other adjoining work from damage during painting. Paint droppings shall be removed, and any damaged surfaces shall be restored to a condition satisfactory to the Owner.

1.9 COOPERATION WITH OTHER TRADES: Schedule this work and coordinate it with other trades and do not proceed until other work and/or job conditions are as required to achieve satisfactory results. Examine drawings and specifications for the work of various other trades and become familiar with all their provisions regarding painting. Surfaces that are left unfinished by requirement of other sections shall be painted or finished as part of the work covered by this section.

1.10 INSPECTION OF SURFACES:

A. Examine surfaces to receive paint finishes, in accord with Contract Conditions, for defects which cannot be corrected by procedures specified herein under "Preparation of Surfaces" and which might prevent satisfactory painting results. Do not proceed with work until such defects are corrected. Commencing of work constitutes acceptance of surfaces and thereafter, Contractor shall be responsible for satisfactory results as required herein.

B. Painting of Previously Painted Surfaces: The painter shall determine paint compatibility with specified products and surfaces previously painted. Should paints be non-compatible, notify the architect. Otherwise, lightly sand or treat surfaces as recommended by the manufacturer prior to installation of paint.

PART 2 - PRODUCTS

2.1 Approved Manufacturers:

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Colors: As selected by Architect from manufacturer's full range.

C. Paints: The following manufacturers are acceptable provided that their products are equivalent or better in quality, appearance, sheen, durability and VOC content to specified system.

1. Sherwin-Williams: www.sherwin-williams.com.
2. PPG Architectural Finishes, Inc: www.ppgaf.com.
3. Rose Talbert Paints: www.rosetalbert.com.
4. Duron Paints: www.duron.com.

2.2 PAINTS AND COATINGS - GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
4. Floor Coatings: VOC not more than 100 g/L.
5. Shellacs, Clear: VOC not more than 730 g/L.
6. Shellacs, Pigmented: VOC not more than 550 g/L.
7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals:VOC not more than 250 g/L.
10. Floor Coatings: VOC not more than 100 g/L.
11. Shellacs, Clear: VOC not more than 730 g/L.
12. Shellacs, Pigmented: VOC not more than 550 g/L.
13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
14. Dry-Fog Coatings: VOC content of not more than 400 g/L.
15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
16. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.

o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

D. Flammability: Comply with applicable code for surface burning characteristics.

E. Colors: As selected by Architect from manufacturer's full range.

1. Selection to be made by Architect after award of contract.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.
3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.3 PREPARATION AND APPLICATION CLEANING: The Painting Contractor will not only protect his work at all times, but will also protect all adjacent work and materials by suitable covering or other method during the progress of his work. Upon completion of the work, he is to remove all paint and varnish spots from the premises, all rubbish and accumulated materials and he is to leave the work in a clean, orderly and acceptable conditions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and re-prime substrate with compatible primers as required to produce paint systems indicated.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Mechanical and Electrical Work: Paint only walls and floor in equipment rooms when scheduled, unless noted otherwise. Paint items exposed in equipment room spaces (when indicated) and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Pipe hangers and supports.
c. Tanks that do not have factory-applied final finishes.
d. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
e. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
f. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:
a. Switchgear.
b. Panelboards.
c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 INTERIOR PAINTING SCHEDULE-Sherwin-Williams Basis of Design

A. CMU Substrates:

1. Masonry/Concrete (at toilets and locker rooms), Opaque, 2-part water-base Gloss Epoxy, 4 coat:
a. Prime Coat: 2 coats Loxon Block Surfacer A24W200 - Architect must inspect walls for smoothness after filler and before any epoxy paint is applied.
b. Finish: 2 coats S-W Pro Industrial Water Based Catalyzed Epoxy; B73-300 Series/B73V300 Hardener

2. High-Performance Industrial Finish Coat Systems (except toilets and locker rooms):
   a. Prime Coat: S-W Loxon Block Surfacer A24W200
   Intermediate: S-W Pro Industrial Acrylic B66-650 Series(S/G) or S-W Pro Industrial Acrylic B66-600 Series(Gloss)
   Finish Coat: S-W Pro Industrial Acrylic B66-650 Series(S/G) or S-W Pro Industrial Acrylic B66-600 Series(Gloss)

B. Steel Substrates:

1. Fast-Drying Water-based Enamel System:

   a. Prime Coat: Pro-Industrial ProCryl Universal Metal Primer B66W310.
   Intermediate Coat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel B531150 Series(S/G) (semi-gloss).
   Topcoat: S-W Pro Industrial Waterbased Alkyd Urethane Enamel B53-1150 Series(S/G) (semi-gloss).

2. Fast-Drying Water-Based Dry-Fall System (shop primed or previously painted substrates – interior metal exposed, except aluminum; Color of mechanical duct work and any other items as indicated on the drawings will contrast with deck color):

   a. Full Prime: S-W Pro Industrial Pro Industrial Pro-Cryl Primer B66W310 or S-W DTM Acrylic Primer/Finish B66W1. Allow 72 hours cure time before top coating.

   b. First Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Semi-Gloss B42W83

   c. Finish Coat: S-W Pro Industrial Waterborne Acrylic Dryfall Semi-Gloss B42W83

3. High-Performance Industrial Finish Coat Systems / Water-Based Dry-Fall System (underside of roof decking used as ceilings – non-ferrous):
   a. Prime Coat: Not needed. Intermediate and Finish Coat Product Self Priming Intermediate: S-W Pro Industrial Waterborne Acrylic Dryfall B42W181(Flat white finish).
      Finish Coat: S-W Pro Industrial Waterborne Acrylic Dryfall B42W181(Flat white finish).

C. Gypsum Board Substrates:

1. Latex System:

Prime Coat: S-W ProMar 200 Zero VOC Interior Latex Primer B28W2600
Intermediate Coat: S-W ProMar 200 Zero VOC Interior Latex Eg-Shel B20-2600 Series
Topcoat: S-W ProMar 200 Zero VOC Interior Latex Eg-Shel B20-2600 Series END

OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior and Exterior room and door signs.

B. Interior directional and informational signs.

C. Emergency evacuation maps.

D. Neon and/or LED Signage

E. Dedication Plaque.

F. Building identification signs.

G. Exterior monument and Wayfinding signs

H. Exterior Building Letters

I. Miscellaneous code required signage

1.02 PRICE AND PAYMENT PROCEDURES

A. See Section 01 2113 - Cash Allowances, for cash allowances affecting this section.

B. Allowance shall include material, submittals/shop drawings, installation, the applicable sales tax thereon, and delivering of all signage to the project site.

C. Sign Schedule: Sign schedule, signage floor plans, and bidding shall be handled by the Architect. A contract will be assigned to the General Contractor. The General Contractor shall not issue a contract on this allowance without prior approval of the Architect.

1.03 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2017.

B. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines; latest edition.

1.04 SUBMITTALS

A. See Section 01-3300 - Submittal Procedures, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. *Contractor shall obtain from the architect well in advance of the submittal process the Signage Floor Plans indicating the permanent Room Identification (Space Name and Space Number) as coordinated with the owner. This plan will be used in lieu of the construction plans for Signage, Fire Alarm Programming and any other use requiring the permanent room names and numbers.*
2. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
3. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
4. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project,

illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Verification Samples: Submit samples of actual materials to be used in project showing colors specified.

G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Store tape adhesive at normal room temperature.

1.07 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 SIGNAGE APPLICATIONS

A. Accessibility Compliance: All signs are required to comply with ADAAG and ANSI/ICC A 117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements. B. Signage:

1. Interior and Exterior room and door signs.
2. Interior directional and informational signs.
3. Emergency evacuation maps.
4. Building identification signs.
5. Exterior Building Letters
6. Miscellaneous code required signage

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs where indicated:

D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers, cabinets, and mounting brackets for fire extinguishers.

B. Provide semi-recessed cabinets and extinguishers in all spaces except Janitor/Custodial Rooms, Mechanical Rooms, Electrical Rooms, Data Rooms and Kiln Rooms. Provide manufacturer's standard wall bracket for these locations. J- hooks are not allowed.

C. Provide non-rated cabinets in non- fire rated walls. All extinguishers and accessories are to be provided in accordance to the Authorities Having Jurisdiction.

D. Provide rated cabinets in fire rated walls. All extinguishers and accessories are to be provided in accordance to the Authorities Having Jurisdiction.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Six years from date of Substantial Completion. PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Acceptable Manufacturers: Larsen's manufacturing Company, J.L Industries, or approved equal.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS AND CABINETS.

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet (FEC) and mounting bracket (FE) indicated.

1. Basis of Design for products listed are by Larsen's Manufacturing Company.
2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multi-Purpose Chemical Type: Extinguisher unit containing a fluidized and siliconized mono ammonium phosphate powder; nonconductive and nontoxic.
1. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
2. Finish: Factory powder-coated; Red.
3. Effectiveness (Rating): Class A, B, and C fires.

2.3 FIRE EXTINGUISHERS AND CABINETS SCHEDULE.

Location	**Mounting Brackets/Cabinet**	**Fire Extinguisher**
Classrooms, Corridors	FEC: Semi-recessed cabinet (2½") #FS-2409-6R with #4 stainless steel finish. Door shall be vertical duo with #4 steel finish and red vertical die tempered glass.	Type MP-10 (A multipurpose extinguisher fully charged with 10 lbs. of dry chemical for A, B, C class fires). Stainless cut lettering mounted on

2.4 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated black baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 42 inches above finished floor to top of fire extinguisher.

2. Cabinets: 4’-0” inches maximum above finished floor to the nozzle.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK SHALL INCLUDE FURNISHING AND INSTALLING THE FOLLOWING:

A. Provide aluminum walkway covers and building mounted canopies as indicated on the drawings, including all necessary accessories to achieve configurations and profiles as indicated on the drawings and specified in this section.

B. Work of this section includes design, engineering, fabrication, and installation of a fully welded, extruded aluminum walkway cover and building mounted canopy systems with protective finish.

1.02 RELATED WORK SPECIFIED AND PERFORMED UNDER OTHER SECTIONS:

A. Paving and surfacing as specified in Section Division 32.

B. Concrete Work as specified in Division 32.

C. Metal Fabrications as specified in Division 5.

D. Flashing and sheet metal as specified in Division 7.

E. Joint Sealers as specified in Division 7.

1.03 REFERENCES

A. AAMA – American Architectural Manufacturers Association.

B. Aluminum Design Manual 2000, Specifications & Guide for Aluminum Structures

C. ASCE 7 – Minimum Design Loads for Buildings and Other Structures.

D. ASTM B221 – Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

E. International Building Code, 201 Edition8

1.04 MEASUREMENTS

A. Verify all dimensions shown on drawings by taking field measurements to insure proper fit and attachment of all component parts.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer's product information, specifications and installation instructions for components and accessories.

B. Shop Drawings: Submit complete erection drawings showing attachment to building structure, attachment systems, column and gutter beam framing, transverse cross sections, covering and trim details, and option installation details to clearly indicate proper assembly of components. Coordinate in advance of wall erection to ensure construction is in compliance the canopy structural engineer's requirements for mounting the canopies to the building. Detailed shop drawings shall be submitted, sealed by a Structural Engineer registered in the State of South Carolina.

C. Certification: Submit written Certification prepared and signed by Structural Engineer registered in the State of South Carolina verifying that framing design will safely resist wind uplift as computed by ANSI A58.1, IV= 150 *mph,* as well as meet indicated loading requirements of the 201 International Building Code and wind loading 8 requirements of the latest ANSI/ASCE 7-98, live and dead loads and other load requirements in accordance with the International Building Code, 201 Edition. 8

Project location is a 120 mph wind speed as indicated on the drawings.

D. A Structural Engineer registered in the State of South Carolina shall specifically design all aluminum walkway covers and building mounted canopies, including columns, brackets, and attachments to the concrete walkway slabs. All such design and submittals shall provide for all loads as indicated on the Drawings, shall be signed and sealed by a Structural Engineer registered in the State of South Carolina, and shall conform to the requirements as set forth by the State Department of Professional Regulation Board of Professional Engineers relating to “Specialty Engineers”.

E. The indiscriminate submittal of general structural calculations that have not been specifically prepared for this project will be rejected.

1.06 QUALITY ASSURANCE

A. Manufacturer to accept total responsibility, from structural design and engineering through fabrication finishing, delivery and erection by factory trained and certified mechanics. Manufacturer shall be a specialist with a minimum five years documented experience in manufacturing product. Installer shall be specialized with a minimum five years documented experience in erecting and applying the work, approved and certified by manufacturer.

B. Size of members to be not less than those shown on drawings.

C. Design Loads: Provide walkway cover and building mounted canopy structures capable of sustaining 120 mph wind speed as indicated on the drawings, and capable of supporting 20 psf live load on roof.

D. Design each member to withstand stresses resulting from combinations of loads that produce maximum percentage of actual to allowable stress in that member.

E. Provide the aluminum walkway covers including all necessary accessories from one single source manufacturer.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and protect products as instructed by manufacturer.

B. Promptly inspect shipment to assure the products comply with requirements, quantities are correct, and products are undamaged.

C. Stack materials to prevent twisting, bending, or abrasion, and to provide ventilation.

D. Slope metal sheets to ensure drainage.

E. Prevent contact with materials during storage that may cause discoloration or staining.

1.07 WARRANTY

A. Provide ten (10) year warranty by manufacturer for installation and materials to cover metal failure, fastener failure, and finish failure. Warranty shall also include, but not limited to, coverage for structural, water tightness and finish beginning the day of Substantial Completion of Installation.

PART 2 GENERAL (MATERIALS)

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements herein, provide products of one of the following:

1. East Coast TVM, LLC
2. Profection Architectural Systems, Inc.
3. Peachtree Protective Covers,
4. Other manufacturers (when pre-approved by the architect prior to bidding) meeting or exceeding the requirements of East Coast TVM, LLC.

B. Basis of Design: System components from East Coast TVM, LLC (All Extruded & Welded System are shown on the Drawings.

2.02 SYSTEM DESCRIPTION

A. Walkway covers and building mounted canopies shall be an all-welded extruded aluminum system complete with internal drainage in flat canopy configurations as indicated on the Drawings. Non-welded items are not acceptable, except for the concealed lighting conduit cover components. Roll form deck is not acceptable. Expansion joints shall be included to accommodate temperature changes of 120 degrees F.

2.03 MATERIALS

A. Aluminum Columns, Beams and Tubing: 6063 alloy heat treated to a T-6 temper, and with not less than the strength and durability properties specified in ASTM B 221 for 6063-T6.

B. Deck Fasteners: 18-8 stainless steel screws, sealed with neoprene “O” ring beneath stainless steel; trim rivets may be aluminum.

C. Grout: Shall be Sakrete concrete mix or equivalent with 4000 – psi compressive strength at 28 days.

D. Columns shall be radius-cornered tubular extrusions of size shown on drawings with cutout and internal diverter for drainage. Circular downspout opening in column is not acceptable.

E. Wet beams shall be open-top tubular extrusions of size and shape shown on drawings; top edges thickened for strength and designed to receive deck members in
a self-flashing manner. Extruded structural rain cap ties shall be installed in the top of all wet beams.

F. Deck shall be extruded self-flashing sections interlocking into a composite unit with sufficient camber to offset dead load deflection and cause positive drainage. Welded plates shall be used as closures at deck ends.

G. All electrical conduits shall be concealed within the canopy system.

H. Fascia shall be manufacturer's standard shape. Size as indicated on drawings.

I. Aluminum column ends embedded in concrete shall be protected with clear acrylic enamel or other acceptable coating to prevent electrolytic reaction with concrete. J.

Material Thickness: Provide minimum thickness of metal as follows:

1. Beams: 0.125 inches on vertical faces and 0.190 inches on horizontal faces.
2. Columns: 0.150 inches.
3. Deck: 0.060 inches.
4. Flashing: 0.032 inches.

2.04 FABRICATION

A. Drainage: Water shall drain internally from deck to beams to columns, for discharge out rain diverters at or below ground level as indicated on the drawings.

B. Bent Construction: Beams and columns shall be heli-arc welded into rigid, one-piece units in the manufacturer's plant. When size of system does not permit shipment, anodizing, or painted finish as welded units, mechanical joints shall be employed. Mechanical joints shall be of stainless steel bolts with a minimum of four bolts per fastening. Bolts and nuts shall be installed in a concealed manner utilizing ½" thick by 1-1/2" aluminum bolt bars welded to members. All welded construction is to be ground smooth prior to finishing. Provide welded end caps ground smooth. C. Field welding is not permitted.

D. Deck Construction: Deck shall be manufactured of extruded modules that interlock in a selfflashing manner. Interlocking joints shall be positively fastened at 18" O.C. creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Deck shall be assembled with sufficient camber to offset dead load deflection.

E. Welded dams shall be fabricated into the roof deck pans at all deck terminations. 2.05

FINISHES

1. Fluoropolymer Coating: 70 percent PVDF resin based fluoropolymer, AA-C-12C-42R1, custom color as selected by architect, comply with AAMA 605.2.
   a. Three coat application.

PART 3 EXECUTION

3.01 PREPARATION

A. Field verify column and beam location dimensions and elevations as shown on shop drawings prior to fabrication.

B. Erection shall be performed after all concrete, masonry, and roof work in the vicinity is complete and cleaned.

C. Perform field modifications as may be required to provide the following:

1.Proper transition from walkway cover to building.

2.Flashing systems and provisions for expansion.

3.02 INSTALLATION

A. Do not proceed with the work of this section until conditions detrimental to the proper and timely competition of the work have been corrected in an acceptable manner.

B. Erection shall be performed by manufacturer-approved erectors and shall be scheduled for erection after all adjacent roofing and masonry have been completed.

C. The manufacturer shall furnish Styrofoam block outs for the columns. Layout and installation shall be by the General Contractor to the dimensions and elevations shown on the approved shop drawings.

D. Columns and beams shall be carefully aligned prior to grouting with Sakcrete concrete mix.

E. All deck ends and beam joints shall be capped as required to control drainage.

F. Butt and miter joints shall be executed in a workman like manner.

G. Walkway covers shall be erected true to line, level and plumb free from distortion or defects detrimental to appearance and performance.

H. No exposed interlocking deck joints visible on the underside of the deck.

I. Counter flashing at wall connections shall be installed under this section.

3.03 CLEANING

A. Clean all walkway cover components promptly after completion.

3.04 PROTECTION

A. Extreme care shall be taken to protect the finish from scratches, nicks, gouges, dents, concrete exposure, etc. during assemble and installation.

END OF SECTION

1.0 GENERAL

1.1 DESCRIPTION OF WORK:

A. Provide all labor, materials and equipment necessary for the complete installation of all casework shown on drawings specified herein.

B. This work includes all modular units in increments of 1" in width. Special, custom and modified units may be furnished as an option.

C. Work Not Included: Rubber or vinyl base, general millwork, floors or ceilings required for reinforcement and support, sinks and fittings, and electrical work.

D. All casework manufacturers shall be required to meet all requirements of these specifications.

1.2 RELATED SECTIONS

A. Millwork, trim, and custom cabinetry: Division 6.

B. Millwork, trim, and custom cabinetry: Division 6.

C. Locks master keyed to room doors: Division 8.

D. Glass: Division 8.

E. Base molding: Division 9.

F. Appliances: Division 11.

G. Sinks and service fixtures, service waste lines, connections, and vents: Division 22.

H. Electrical service fixtures: Division 26.

1.3 DEFINITIONS:

A. Identification of casework components and related products by surface visibility.

1. Open Interiors: Any open storage unit without solid door or drawer fronts, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.

2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts.

3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.

4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.

5. Semi-Exposed Surfaces: Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.

6. Concealed Surfaces: Any surface not visible after installation.

1.4 SUBMITTALS:

A. The casework manufacturer shall furnish shop drawings on manufacturer's title block giving all details and sizes, including methods of attachment and anything pertinent to the installation work,

as soon as possible after the award of the Contract. He shall include full specification requirements, including color samples of all finishes for the Architect's selection.

Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.

1. Include section drawings of typical and special casework, work surfaces and accessories.

2. Indicate locations of plumbing and electrical service field connection by others.

3. Provide one set of shop drawings which includes all products within this section, engineered and built by a single source manufacturer, with seamless coordination amongst all products.

B. Component samples: Two sets of samples for each of the following:
1. Decorative laminate color charts / 3mm PVC and ABS edgings, provide with submittal.

C. The casework manufacturer and supplier shall keep aware of the progress of the project and shall make sure that shop drawings are furnished in adequate time so that the casework covered thereby can be fabricated and delivered in accordance with the scheduled completion.

D. The manufacturer and/or supplier shall be responsible for making field measurements to insure proper fit of all casework items. Shop drawings shall be based on actual field measurements.

E. All manufacturers shall submit for approval, prior to submitting show drawings, full size cabinet sample(s), showing all requirements of these specifications. After approval of sample(s), the manufacturer can then proceed to submit shop drawings for approval. Shop drawings shall be complete in all details. Submittals received without mock-up approval by architect will be not be accepted.

F. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

G. Sustainable Design Submittal:
1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.

2. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.

3. Plastic Laminate-Faced Architectural Cabinets; Certified Wood: Wood products shall be certified according to the American Tree Farm System's "AFF Standard," the AF&PA's Sustainable Forestry Initiative, FSC STD-01-001 and FSC STD-40004, or the standards of the Programme for Endorsement of Forest Certification.
4. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
    a. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

1.5 QUALITY ASSURANCE:

A. Manufacturer: Minimum of 5 years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.

B. Manufacturer: Provide products certified as meeting or exceeding ANSI-A 161.1-2000 testing standards.

C. Single Source Manufacturer: Casework, countertops and architectural millwork products must all be engineered and built by a single source manufacturer in order to ensure consistency and quality for these related products. Splitting casework, countertops and/or architectural millwork between multiple manufacturers will not be permitted.

D. Fabricator Qualifications: Certified participant in AWI's Quality Certification Program.

E. Installer Qualifications: Fabricator of products Certified participant in AWI's Quality Certification Program.

1.6 PROJECT CONDITIONS:

A. Casework shall not be delivered to project site until dry and heated storage space is provided. The casework specified under this section is pre-finished, and precaution must be taken to protect it against damage during installation and until final acceptance.

B. The casework contractor shall verify climatic conditions, in areas where casework is to be stored and/or placed, and note any discrepancies to the general contractor with copies to the architect prior to shipment.

C. Contractor shall be responsible for all quantities as shown on casework layouts on drawings.

D. Environmental Requirements: Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week. a. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
b. After installation, control temperature and humidity to maintain relative humidity between 25 percent and 55 percent.

E. Conditions: Do not install casework until interior concrete work, masonry, plastering and other wet operations are complete.

1.7 WARRANTY:

A. All materials and workmanship covered by this section will carry a five (5) year warranty from date of Substantial Completion.

1.8 MANUFACTURERS: Shall be a certified participant in AWI's Quality Certification Program.

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer’s acceptable upon compliance with the contract documents are:
1. TMI Systems – Dickerson, North Dakota
2. Case Systems Inc, Midland MI

3. Stevens Industries, Inc – Teutopolis, Illinois

2.2 WORKMANSHIP - GENERAL:

A. All exposed exterior vertical surfaces finished with high pressure plastic laminate, unless otherwise indicated.

B. All parts machined for accurate fit and assembled with hardwood dowels and adhesives to result in true, square, level and plumb units.

C. Verify dimensions of other trades to be built into casework prior to fabrication.

D. End panels shall be doweled to receive bottom and top. Back panel shall be fully housed into cabinet sides, top and bottom to insure rigidity and a fully closed cabinet.

E. Drawer bottom shall be fully housed into sides, back, and subfront or undermount. Sides of drawer shall be doweled to receive drawer back, locked in fully to subfront, fastened with glue and mechanical fasteners.

F. Rear of cabinet back, wall, and base joints shall receive a continuous bead of hot melt adhesive to add to unit body strength and develop moisture seal.

G. Scribe all tops and backsplashes to walls and other adjoining vertical surfaces.

H. There shall be a maximum scribe width of 1-1/2" at all cabinets abutting walls unless shown otherwise.

2.3 MATERIALS:

A. Laminated Plastics/Finishes:

1. High pressure plastic laminate, GP-50, for exterior horizontal cabinet surfaces shall meet NEMA standards.

2. High pressure plastic laminate, GP-28, for exterior vertical cabinet surfaces shall meet NEMA standards.

3. Color Selection Available:

a. Textured finish vertical surface grade from Wilsonart or Nevamar's standard stock colors consisting of both wood grain patterns and solid colors.

b. Cabinet faces to be one color unless noted otherwise on plans. Finish end panels will be same color as cabinet face from standard color selection.

c. Direction of wood grain to be vertical on door, end panels and exposed backs; horizontal on drawer faces, aprons and top rails.

4. Plastic Laminate Balancing Sheet: Selected from manufacturer’s standard color line, CL20 cabinet liner with textured surface to meet NEMA standards shall be used to balance door and drawer face and finished end face.

5. Counter Top High-Pressure Plastic Laminate:

a. High pressure plastic laminate, satin, or textured finish .050 thickness. Color as selected from manufacturer's standard price group patterns and solid colors. Color as selected from manufacturer's premium price group patterns and solid colors.

b. Heavy gauge neutral colored backing sheet for balanced construction.

6. Melamine Thermoset Decorative Panels:

a. Thermally fused melamine TFM laminate, NEMA Test LD 3-2005. (TFM allowed on casework interiors only, as specified below. Utilization of TFM on any exterior casework surfaces, including door and drawer faces and finished ends, will not be permitted.)

b. Colored melamine laminate for semi-exposed cabinet interiors behind doors and drawers selected from manufacturer's standard color line.

B. Core Materials:

1. 1.Particleboard up to 7/8-inch-thick: Industrial Grade average 45-pound density particleboard, ANSI A 208.1-2009, M-2 requirements.

2. Particleboard 1 inch thick and thicker: Industrial Grade average 45-pound density particle-board, ANSI A 208.1-2009, M-2 requirements.

3. Medium Density Fiberboard 1/4-inch-thick: Average 54-pound density grade, ANSI A208.2-2009 requirements.

4. MR Moisture Resistant Particleboard: Average 45-pound density particleboard, ANSI A208.1 1-2009, M-2 requirements. *(for use in all Out-Building casework)*

C. Edging:

1. Solid, high impact, purified, color-thru, acid resistant, PVC edging machine applied with hot melt adhesives, automatically trimmed for uniform appearance.

2. 3mm PVC banding, machine applied and machine profiled to 1/8-inch radius for counter tops and all edges (cabinet body and shelf edges, door/drawer front edges). Provide the 3mm system at all exposed penetrations through top, sides, or fronts of cabinets or where exposed to view.

3. Outside edges of counters shall be eased with a ½" radius.

4. Edging shall be by: Woodtape, Canplast or approved equal, using standard match edge colors as selected by the architect.

D. Hardware:

1. Hinges:

a. Heavy Duty, five knuckle 2 ¾" institutional type hinge: Hospital tip, tight pin feature with all edges eased. Hinge to be wrap-around type tempered steel, .095 inch thick. Each hinge to have nine screws, two 5mm x 13mm and seven #7, 5/8" FHWS to assure positive door attachment.

b. Two hinges per door to 36" in height. Three hinges per door to 70" in height and 4 hinges per door to 94" in height. Hinge to accommodate 13/16" thick plastic laminate door.

c. Finish to be nickel plated.

d. Other fully concealed hinges with lifetime warranty are available upon request.

2. Pulls: Should metal, wire type 4" long mounted with two (2) screws fastened from back. Pulls shall be chrome colored powder coated with color as approved by architect. Provide two (2) pulls for drawers over 24" wide. Other ADA compliant pull options may be

acceptable when selected from manufacturer's standards of same price line as the specified 4" pull.

3. Drawer Slides: Regular, kneespace and pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature. Paper storage, 150-pound load rated epoxy coated steel slides.

4. Adjustable Shelf Supports: Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32mm centers. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support automatically adapts to 3/4 inch or 1-inch thick shelving and provides non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

5. Wardrobe Rod: To be 1 - 1/16-inch diameter, 14-gauge, chrome steel rod supported by chrome flanges.

6. Sliding Door Track: Anodized aluminum double channel. Continuous top and bottom.

7. File Suspension System: Extruded molding integral with top of drawer box sides to accept standard hanging file folders.

8. Locks:
   a. Removable core, disc tumbler, cam style lock with strike. Lock for sliding 3/4inch-thick doors is a disc type plunger lock, sliding door type with strike. Lock for sliding glass/acrylic doors is a ratchet type sliding showcase lock.
   b. For multi-drawer pedestals and lateral files provide gang locks in top drawer of pedestal.
   c. Elbow catch or chain bolt used to secure inactive door on all locked cabinets.

E. Specialty Items:
   1. Grommets:
      a. For Cable Passage through Countertops: 2-inch (51-mm) OD minimum, color as selected by architect from manufacturer's standard colors, molded-plastic grommets and matching plastic caps with slot for wire passage.
   2. Support Members:
      a. Countertop support brackets: Epoxy powder coated, 11-gauge steel with integral cleat mount opening and wire management opening.
      b. Under counter support frames: Epoxy powder coated.
      c. Legs: Epoxy powder coated.
   3. Computer Keyboard Tray:
      a. Non-articulating, undercounted mount with positive stop drawer slides.
      b. Articulating keyboard trays with attached mouse pad where specified by architect (see drawings).

F. Glass:
   1. Wall unit full sliding glass doors: 1/4-inch-thick laminated safety glass.
   2. Glass insert doors, hinged or sliding wall cabinets: 1/4-inch-thick laminated safety glass.
   3. Glass insert doors, hinged or sliding tall or base cabinets. 1/4-inch-thick laminate safety glass.

4. Sliding doors mounted in aluminum track.
5. Trim glass inserts: Extruded rigid PVC channel and self-locking insert retainer strip.

2.4 FABRICATION (Detailed Requirements for Cabinet Construction):

1. Sub Base:
   a. Cabinet Sub-Base: To be separate and continuous (no cabinet body sides-to-floor), semi-concealed fastening to cabinet bottom. Ladder-type construction in front, back and intermediates to form a secure and level platform to which cabinets attach. 3/4” pressure treated plywood.

2. Cabinet Top and Bottom - Wall and Base:
   a. Base cabinet bottoms to be selected from manufacturer’s standard color line of melamine laminated particle board two sides, 3/4" thick.
   b. Solid sub-top to be 3/4" melamine for all base cabinets.
   c. Exterior exposed wall cabinet bottoms to be CP28 High Pressure Laminate on both sides.

3. Cabinet Ends:
   a. To be selected from manufacturer’s standard color line of melamine laminate particle board both sides, 3/4" thick. Holes drilled for adjustable shelves 1-1/4" on center.
   b. Exposed exterior cabinet ends to be laminated and opposite side laminated with CL-20 cabinet liner.

4. Fixed and Adjustable Shelves:
   a. To be selected from manufacturer’s standard color line of melamine laminate particle board two sides. Leading exposed edge of shelves to be edged with Flat Edge PVC color as selected by the architect.
   b. Thickness: 3/4" standard shelving 30 inches and less
   c. Thickness: 1" for 30" to 36". No shelves/cabinets are to exceed 36”.
   d. Stack shelving to be 1" thick.

5. Cabinet Backs:

a. Standard cabinet back to be 1/2" thick. To be selected from manufacturer’s standard color line of melamine for use on all cabinets with or without doors. Unexposed wall side of back to receive a continuous bead of elastic hot melt adhesive at joint between back and sides/top/bottom for sealing against moisture and further contribute to case rigidity.
b. Exposed exterior backs to be 3/4" particle board faced with high pressure plastic laminate.

6. Doors and Drawer Fronts:
   a. Plastic Laminate doors and drawer fronts to be 13/16" thick for all hinged and sliding doors. Core material to be 3/4" thick, 47 lb. density particle board bonded on exterior with high pressure laminate and with colored CL-20 Cabinet Liner on interior face. Drawer fronts and hinged doors are to overlay the cabinet body. Maintain a maximum 1/8" reveal between pairs of doors, between doors and drawer front, or between multiple drawer fronts within the cabinet.
   b.Top edge banded with 3mm PVC.

7. Drawers:
   a. Drawer fronts shall be applied to separate drawer body component subfronts.

b. Sides, back & sub front of drawers to be minimum 1/2" thick particle board (225lb edge screw hold and 247 lbs face screw hold properties), laminated with TFM Thermally Fused Melamine doweled and glued into sides. Top edge banded with 3mm PVC.c.Exposed top edge to be Flat Edge PVC, white in color.
c. Exposed top edge to be Flat Edge PVC, white in color.
d. Drawer bottom to be minimum 1/2-inch-thick particleboard (225lb edge screw hold and 247 lbs face screw hold properties), laminated with TFM Thermally Fused Melamine, screwed directly to the bottom edges of drawer box.
e. Drawer sides shall be doweled to receive front and back, machine squared and held under pressure while glued and pinned together.
f. Drawer bottom to be white color melamine laminate, 1/4" thick, housed and glued into front, sides and back. Underside of drawer to receive continuous bead of hot melt adhesive at joint between bottom, sides, front and back for sealing and rigidity.
g. All drawers shall have roller guides as specified.

8. Door / Drawer Spreaders: Provide a minimum 3/4" x 4-1/2" x full width white finished cabinet body spreaders immediately behind all door/drawer and multiple drawer horizontal joints to maintain exact body dimensions, and close off reveal. Front edge to be Flat Edge PVC.

9. Counter Tops:
   a. High pressure decorative HGS/HGP plastic laminate bonded to 1-1/8" thick particle board core, except entire counter top where sink occurs shall be 3/4" thick exterior grade plywood with built-up edge. Furnish counter tops in design as shown on drawings. Provide continuous tops for counter type cabinets fixed in a line.
   b. Edge Treatment: 3-mm PVC edging.
   c. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.
   d. Paper Backing: Provide paper backing on underside of countertop substrate.
   e. Ease outside corners with a ½" radius.

10. Miscellaneous Shelving (Exposed/not in Cabinets):
   a.Core material: 1-inch thick particleboard.
   b.High-pressure decorative VGS laminate on both faces.
   c.Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8-inch radius.

3.0 EXECUTION

3.1 INSPECTION:
A. The casework contractor must examine the job site and the conditions under which the work under this section is to be performed, and notify the building owner in writing of unsatisfactory conditions. Do not proceed with work under this Section until satisfactory conditions have been corrected in a manner acceptable to the installer.

3.2 COORDINATION:
A. Coordinate work of this section

B. Verify site dimensions of cabinet locations in building prior to fabrication.

3.3 INSTALLATION:

A. Erect casework, plumb, level, true and straight with no distortions. Shim as required.

Where laminate clad casework abuts other finished work, scribe and cut to accurate fit.

B. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.

C. Repair minor damage per plastic laminate manufacturer's recommendations.

D. Shop drawings and installation instructions furnished by the manufacturer shall be strictly adhered to. Mechanics making the installation shall be experienced in this type work and capable of the highest quality of workmanship.

E. Counter tops shall be installed flush against the wall. Provide clear silicon sealant where cabinet meets backsplash, at sinks and where required for sanitation. Provide paintable latex caulking at tops of backsplash, and around ends of counter tops where they meet wall surfaces. Verify colors of paintable caulking with the architect.

F. The Contractor for the work of this section shall cut all openings in counter tops for sinks or other items required. Cut to size from template furnished by supplier of sinks or use sinks on job.

G. The Installer of the cabinet work shall make use of filler stations and scribe panels to fit cabinet work into specific dimensions.

H. Exposed fasteners are not acceptable. Ant exposed fasteners shall be stainless steel.

3.3 FIELD QUALITY CONTROL:

A. All defective workmanship or damaged components shall be corrected, repaired or replaced, as requested by the Architect, without further cost to the Owner.

B. General Contractor is responsible for protection of casework from damage to other trades upon completion of installation by casework supplier.

3.4 ADJUSTMENT:

A. Provide all door bumpers, drawer slides, etc., after installation to provide proper operation.

3.5 CLEANING:

A. Exposed surfaces, edges and cabinet interiors shall be cleaned and all construction and installation marks removed prior to acceptance by Owner.

B. Supplier of this equipment shall be responsible for the immediate removal and disposal of all trash, crating, etc.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Solid surfacing millwork and window sills.
B. Adhesives and sealants.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Submittals.
B. Section 01 7700 - Closeout Submittals.
C. Section 05 5000 - Metal Fabrications.
D. Section 06 1000 - Rough Carpentry.
E. Section 06 2000 – Finish Carpentry Millwork
F. Division 22 - Plumbing Sections.

1.03 REFERENCES

A. Reference Standards:
1. ASTM C 834: Standard Specification for Latex Sealants.
2. ASTM C 920: Standard Specification for Elastomeric Joint Sealants.
3. ASTM D 256: Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
4. ASTM D 570: Standard Test Method for Water Absorption of Plastics.
5. ASTM D 638: Standard Test Method for Tensile Properties of Plastics
6. ASTM D 696: Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C with a Vitreous Silica Dilatometer.
7. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
8. ASTM D 792: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
9. ASTM D 2583: Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
10. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM G 21: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
12. ASTM G 22: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Bacteria.
13. ASTM G 155: Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.
14. SCAQMD Rule 1168: Adhesive and Sealant Applications.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 3000 - Submittals.
B. Product Data:
1. Submit product data for each specified product. Include manufacturer's technical data sheets and published instruction instructions.
2. Submit Material Safety Data Sheets (MSDS) for adhesives and sealants.
C. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

D. Shop Drawings:

1. Submit fully dimensioned shop drawings showing countertop and window sill layouts, joinery, terminating conditions, substrate construction, cutouts and holes. Show plumbing installation provisions. Include elevations, section details, and large scale details.

E. Samples:
1. Submit selection and verification samples for each color, pattern, and finish required.

F. Quality Assurance Submittals:
1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties, if required.
2. Warranty: Specimen copy of specified warranty.

G. Maintenance Data: Submit manufacturer's published maintenance manual with closeout submittals.

1.05 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with the U.S. Architectural & Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines for Buildings and Facilities. B. Adhesives, Sealants, and Sealant Primers:
1. SCAQMD (South Coast Air Quality Management District) Rule 1168.

1.06 QUALITY ASSURANCE

A. Qualifications:
1. Fabricator Qualifications: Minimum of three years documented experience in fabricating solid surfacing countertops similar in scope and complexity to this Project. Currently certified by the manufacturer as an acceptable fabricator.
2. Installer Qualifications: Minimum of three years documented installation experience for projects similar in scope and complexity to this Project (provide list of projects and photographs of end product), and currently certified by the manufacturer as an acceptable installer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver counter tops and sills in protective wrappings.
B. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer. Store sheet materials flat on pallets or similar rack-type storage to preclude damage.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays. Coordinate locations of outlet for power/data/communication with General Contractor, all other concerned trades, and Architect.

B. Adhesive: Acclimatize adhesives to occupancy room temperatures with maximum temperature not to exceed 75 deg F.

1.09 WARRANTY

A. Manufacturer's Limited Warranty: Provide manufacturer's standard 10 Year Commercial Limited Warranty against defects in solid surface sheet materials.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: Wilsonart LLC.

2.03 QUARTZ SURFACING SHEET MATERIAL: This material is used in the Serving D105.K Serving Line.

A. Acceptable Product: ""Wilsonart Quartz."
B. Composition: 93 percent quartz aggregate combined with polyester resin binders and proprietary pigments that are fabricated into slabs using vacuum vibrocompaction technology.
C. Material Thickness: Product Type 062 - 0.79 inch (2 cm), nominal.
C. Conformance Standards:
1. NSF/ANSI Standard 51. 2. UL 2818:
a. GREENGUARD - Emission levels in UL 2818, Section 7.1 are applicable for furniture products.
b. GREENGUARD Gold - Emission levels in UL 2818, Section 7.2 are applicable for building materials, finishes, and furnishings.
E. Physical Characteristics:
1. Flexural Strength: Greater than 4,500 psi; ASTM D 790.
2. Flexural Strain: Less than 0.375 percent; ASTM D 790.
3. Flexural Modulus: Greater than 3.75 MPsi; ASTM D 790.
4. Stain Resistance (24 Hour): No effect to moderate effect; NEMA LD-3.
5. Abrasion Resistance: Greater than 100 in.-lbs.; ASTM C 501.
6. Density: Greater than 2.1 g/cm3; ASTM C 97.
7. Compressive Strength (One Axis - Dry): Greater than 20,000 psi; ASTM C 170.
8. Moisture Absorption: Maximum 0.022 percent; ASTM C 97.
J. Quartz Finish: Polished finish with Glossometer reading greater than 45.
F. Color, Pattern, and Finish Design: Selected from manufacturer's standard offerings.
G. Edge Detail: Selected from manufacturer's standard offerings.

2.04 ACCESSORY MATERIALS

A. Joint Adhesive: Product recommended by quartz agglomerate manufacturer. Color complementary to solid surfacing sheet material. Adhesives shall have a VOC content of[70 g/L or less.
1. Product: "Wilsonart Hard Surface Adhesive."

EMERALD HIGH SCHOOL – ADDITIONS & RENOVATIONS SECTION 12 3661
GREENWOOD SCHOOL DISTRICT 50 SOLID SURFACING COUNTERTOPS AND SILLS

B. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

C. Elastomeric Sealant: Mildew-resistant silicone sealant for filling gaps between countertops and terminating substrates in wet environment applications. Complies with ASTM C 920, Type S (single component), Grade NS (nonsag).
   1. Product: Acceptable to countertop manufacturer.
   2. Color: Complementary to solid surfacing color
D. Siliconized Acrylic Sealant: Siliconized acrylic latex sealant. For general applications to fill gaps between countertops and at terminating substrates. Complies with ASTM C 834, Type OP, Grade NF, and SCAQMD Rule 1168.
   1. Product:" Wilsonart Color Matched Caulk".
   2. Color: Complementary to solid surfacing color
E. Construction Adhesive: Countertop manufacturer's recommended silicone-based construction adhesive for backsplashes, endsplashes, and other applications according to manufacturer's published fabrication instructions.

2.05 FABRICATION

A. Fabricate components in shop, to greatest extent practicable, in sizes and shapes indicated according to approved shop drawings and Wilsonart published fabrication requirements.
B. Form joint seams between solid surfacing components with specified seam adhesive. Completed joints inconspicuous in appearance and without voids. Provide joint reinforced if required by manufacturer for particular installation conditions.
C. Provide holes and cutouts indicated on approved shop drawings. Rout cutouts and complete by sanding all edges smooth.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions that could adversely affect the work of this Section.
B. Substrates must be sound, flat, smooth, and free from dust or other surface contaminants.
C. Commencement of work will constitute acceptance of substrates and conditions to receive the work.

3.03 WINDOW SILL INSTALLATION

A. Install window sills for full length of each window unit, securing to substrates with concealed fasteners and specified adhesive.
B. Provide minimum 1/8" expansion gap on both sides of window sills. Fill gap with specified joint sealant.
C. Completed work to be plumb, level, and true, with edges eased and sanded smooth.

3.04 REPAIRS

A. If permissible to Architect, minor surface marring for solid surfacing components may be repaired according to manufacturer's published installation instructions.
B. Remove and replace solid surfacing components that are damaged and cannot be satisfactorily repaired.

3.05 CLEANING AND PROTECTION

A. Clean solid surfacing components according to manufacturer's published maintenance instructions. Completely remove excess adhesives and sealants from finished surfaces. B. Protect completed work from damage during remainder of construction period.

END OF SECTION 12 3661

PROJECT MANUAL

VOLUME 2 of 2

Additions & Renovations EMERALD HIGH SCHOOL

GREENWOOD SCHOOL DISTRICT 50
GREENWOOD, SOUTH CAROLINA

JCS Commission No. 21010

JANUARY, 2023

Jumper Carter Sease ARCHITECTS

VOLUME 2

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

DIVISION 25 INTEGRATED AUTOMATION

DIVISION 26 ELECTRICAL

DIVISION 31 EARTHWORK

DIVISION 32 EXTERIOR IMPROVEMENTS

DIVISION 33 UTILITIES

APPENDIX 'A'

APPENDIX 'B'

APPENDIX 'C'

END OF SECTION

SECTION 21 13 00 - MECHANICAL, AUTOMATIC SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 23 00 00, MECHANICAL, GENERAL applies to work of this section of these specifications. Refer to Automatic Sprinkler System drawing *(Sht SP1)* for work and materials for this section of the specifications.

1. Refer to 10 day prior approval requirements for substitutions of materials and equipment.

2. All work shall be accomplished by a Fire Sprinkler Contractor certified and licensed as a qualified Fire Protection Contractor regularly engaged in the design and installation of fire sprinkler systems under the Laws of the State of South Carolina.

1.2 SCOPE

A. All work and materials shall be in accordance with National Fire Protection Association NFPA 13 -
2016, IBC International Building Code - 2018, IBC International Fire Code - 2018 and all applicable codes and standards. Installation shall be in accordance with the requirements of Seismic of the IBC International Building Code.

B. Sprinkler equipment and installation shall be in strict accordance with recommendations of the Insurance Underwriters for the project and the South Carolina Department of Education including the local authority having jurisdiction.

C. Sprinkler System Design: Sprinkler system design shall be based on occupancy classifications for all areas of the building in accordance with NFPA 13 and as noted on drawings.

D. Provide installation of approved wet pipe automatic fire protection sprinkler system for building addition as indicated on drawings. This work shall include the connection to the existing sprinkler system, the installation of all piping, sprinkler heads, materials and equipment for complete sprinkler system coverage for the building addition as indicated on drawings. This shall include the following:

! *Preliminary Shop Drawings*
! *Revised Preliminary Shop Drawings*
! Sprinkler Piping
! Sprinkler Heads
! Seismic Plates
! Pipe Sleeves and Supports
! Fire Caulking Materials
! Submittals
! Tests Including Materials and Test Certificates

G. Tap Fees for fire sprinkler service are covered under another section of these specifications.

H. Fees for construction permits shall be included.

I. FIRE FLOW TEST DATA:

1. Contractor shall obtain current fire flow test data and field verify existing conditions prior to the design of sprinkler systems and submission of drawings and calculations to the Engineers office for review. Current flow test shall be established after award of contract, before completion of design calculations for shop drawing review.

J. Wiring for sprinkler system alarm and trouble devices shall be furnished under Division 26 of these specifications. Coordinate electrical voltages and requirements with electrical prior to ordering any equipment to prevent conflicts.

1.3 SHOP DRAWINGS

A. Contractor shall prepare *preliminary shop drawings* of the installation and shall submit (1) set of drawings with calculations and product data sheets to the Architect for preliminary review by the Engineer in accordance with plans and specifications. The *preliminary shop drawings* shall be furnished as soon as possible after award of contract as required to expedite the review process. Refer to IBC Standard Building Code Section 106 para. 106.1.1.1 for shop drawing review requirements. Shop drawing review is required prior to start of system installation.

1. Contractor shall include a Data Sheet for Engineer use and verification with *preliminary shop drawings* and calculations. *(Furnish current flow test data, location and elevation and all test information as applicable)*

2. **Email (electronic) submission of preliminary shop drawings, calculations and data sheets for Engineer review will not be accepted.**

B. Contractor shall include in his bid a design review meeting with the Engineer to review and coordinate shop drawing comments before delivery of shop drawings to the State Fire Marshal for final review. This meeting shall be scheduled at the Engineer's office in Columbia. After attending this Engineer review meeting contractor shall revise *preliminary shop drawings* and calculations as required to comply with all *preliminary review comments*.

C. Furnish (1) set of revised drawings and calculations to the Engineer for final review once all preliminary comments have been addressed and revisions completed. Indicate revision number and date on revised shop drawings prior to submitting project to Engineer. Engineer will furnish updated Data Sheet and Certificate of Compliance for contractor's submission of shop drawings to the State Fire Marshall's office.

D. Contractor shall submit completed revised shop drawings, updated Data Sheet and Certificate of Compliance to the State Fire Marshall's office for review.
1. *Data Sheet and Certificate of Compliance shall have Engineer stamp and signature including revised drawings noted on Certificate of Compliance prior to submission to State Fire Marshal*.

2. Contractor shall make all changes necessary for obtaining final approval from the State Fire Marshall prior to start of construction.

3. Contractor shall furnish minimum (6) printed and bound sets of completed shop drawings to the General contractor along with copies of the Acceptance Letter from the State Fire Marshal once final review and acceptance has been completed.

E. Review of contractor's drawings shall not relieve him from the responsibility for errors, omissions or deviations from plans and specifications, unless the contractor has called the Owner's attention to such deviations in writing at time of submittal.

1.4 ALTERNATES

A. Refer to the Architectural drawings, specifications and addenda for descriptions of all Alternates by the Architect as they apply to Division 21 Mechanical, Automatic Sprinkler Systems.

B. It shall be the responsibility of the contractor to coordinate all sprinkler system work under Alternates and to notify the Engineer prior to bid date if any discrepancies occur concerning the Alternates or if any clarification of work under Alternates is required. No extra charge will be approved after start of construction from failure to follow these instructions.

1.5 CONSTRUCTION PHASING

A. Coordinate all construction with the Architect, Construction Manager, Owner and General Contractor prior to starting any work. Phasing of work relating to the sprinkler systems shall be closely coordinated to prevent problems. Notify Engineer/Architect prior to starting work if any problems exist concerning phasing of work.

PART 2 - PRODUCTS

2.1 SPRINKLER PIPING

A. Piping for sprinkler systems shall be UL listed metallic pipe and materials in accordance with NFPA 13, paragraph 6.3 and as specified below.

1. Piping 2" and smaller shall be minimum sch 40 black steel, rolled-groove or threaded.

2. Piping 2-1/2" and larger shall be minimum sch 10 black steel, rolled-groove.

B. All sprinkler system piping and materials shall be run concealed above ceilings, in furred spaces and in chases where possible. Coordinate all finishes and space requirements with existing conditions, Architectural drawings and specifications as required prior to installation.
   1. Review of shop drawings for sprinkler systems will require coordination of locations of piping and sprinkler heads as required to maintain a concealed system whenever possible.

C. Piping shall meet the requirements of NFPA 13 for Identification of Pipe. Piping which does not meet this requirement will not be permitted for use.

D. Maintain flexible couplings on both sides of rated wall penetrations. Flexible couplings shall meet requirements for seismic at all rated penetrations.

E. UL and FM listed flexible sprinkler head drops may be used in lieu of pipe for all sprinkler head drops. Manufacturer of these products shall provide drops with type 304 stainless steel braided hose for all flexible drops to maintain integrity of installation and to prevent unnecessary crimping or bending of drops during or after installation.

1. Provide seismic clips and install in accordance with manufacturer's instructions.

2. Maintain equivalent lengths in calculations for manufacturer product used to comply with State Fire Marshal requirements.

3. Flexible sprinkler head drops as manufactured by Flexhead Industries or Victaulic VicFlex will be accepted.

F. Provide expansion pipe loop if sprinkler piping crosses an existing or proposed 3-hr wall.

2.2 SPRINKLER HEADS

A. Sprinkler heads shall be UL/FM approved for intended service. Sprinkler heads as manufactured by Reliable, Star, Victaulic, Gem or Viking Sprinkler Corporation will be accepted.

1. Coordinate all finishes with Architectural drawings and specifications as required.

2. Extended 2-piece pot metal escutcheons will not be permitted for sprinkler heads.

3. Sprinkler types and coverages (hazard classifications) shall be as required by NFPA-13 and as indicated on drawings.

4. Provide flush mounted seismic plates for sprinkler heads as required. Seismic plates shall be white.

5. Provide semi-recessed pendent sprinkler heads for installation in finished ceilings throughout this project.

6. Provide brass upright heads for area aove suspended ceiling as noted on drawings.

7. Contractor shall center sprinkler heads in entire ceiling tiles.

2.3 PIPE SUPPORTS

A. Pipe supports shall be Factory Mutual approved for fire sprinkler systems and shall be in accordance with NFPA 13, Chapter 9. Provide additional brackets, angles and bracing as may be required to install piping per NFPA standards.

B. See para. 3.2 of these specifications for seismic calculations.

2.4 PIPE SLEEVES AND ESCUTCHEONS

A. Core holes where all pipes pass through block wall construction, sized to allow clearance entirely around the passing pipe in accordance with seismic requirements of NFPA-13.

1. Sleeves in bearing walls and floors shall be made of Sch 40 steel pipe. Extend vertical sleeves a minimum of 1" above finished floor. Install all pipe sleeves in a waterproof manner.

2. Sleeves in other walls shall be made of 20 gauge galvanized steel.

3. Maintain openings in all walls as required to meet seismic penetration guidelines.

4. See Architectural drawings for locations of smoke walls. Contractor shall fill the space between the pipe and the opening by tightly packing with rock wool to maintain a positive smoke seal for entire penetration.

B. See Architectural drawings for locations of fire rated assemblies. Provide pipe sleeves where pipes pass through fire-rated walls or floors. The space between the pipe and the pipe sleeve shall be filled with a UL rated through wall penetration system fire proofing material. Install in accordance with the manufacturer's specific instructions. Installation of fire stopping and sealing of all penetrations is included in this section of these specifications.

1. Failure to comply will require the removal of caulking materials and replacement with UL fire rated materials and sleeves as specified. Submit data sheets for caulking materials for Engineer review. See Architectural drawings for wall ratings and locations.

2. *See detail on drawings for applicable UL penetration assemblies*.

3. Maintain flexible couplings on both sides of wall penetrations. Flexible couplings shall meet requirements for seismic at all rated penetrations.

4. Sleeves in bearing walls and floors shall be made of Sch 40 steel pipe.

5. Openings shall not be excessively large and/or irregular for efficient fire stopping details. All firestopping throughout the building shall utilize the same manufacturer's products to ensure compatibility and consistency of penetration seals. Coordinate with the general Contractor and other trades prior to beginning firestopping work. See Section 07 84 00 **Firestopping and Smoke Seals** for additional requirements.

C. Maintain sleeves throughout project with sleeves grouted neatly in place after installation. Coordinate grouting with general contractor as required.

D. Contractor may provide flexible couplings on both sides of penetrations in lieu of maintaining clearances around piping in accordance with NFPA-13, paragraph 9.3.4.5.

2.5 SPRINKLER SYSTEMS CHARTS

A. Modify system chart mounted on wall at existing sprinkler riser location to identify new system areas and functions.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Submit detailed shop drawings, equipment and material cut sheets, and product data for all items.

1. All product data shall be submitted at one time in complete detail. Partial submission will not be accepted.

2. Contractor shall submit seismic design calculations complete with shop drawings and materials for engineer review in accordance with applicable State Fire Marshal and NFPA 13 requirements.

B. Submit data sheets for the following items with shop drawings for *preliminary review*:

! Sprinkler Heads
! Pipe Sleeves and Escutcheons
! Fire Caulking Materials
! Preliminary shop drawings
! Calculations including data sheets with current information
! Current Fire Flow Test
! Seismic Calculations

C. Provide name, address, phone number and zip code for general contractor on sprinkler shop drawings as required to meet State Fire Marshal review requirements.

3.2 SEISMIC RESTRAINT OF PIPING

A. Seismically restrain all piping in accordance with NFPA 13 for requirements for Seismic of the IBC International Building Code.

B. Indicate locations for all seismic straining devices on sprinkler shop drawings as required to meet State Fire Marshal review requirements.

C. Provide seismic calculations on sprinkler shop drawings as required to meet State Fire Marshal review requirements.

D. Contractor shall reference Architectural and structural drgs for seismic data as applicable.

3.3 CERTIFICATE OF APPROVAL

A. Upon completion of all work, furnish the owner a *Certificate of Approval* from the local fire department and the State Fire Marshall's Office, including materials and properly witnessed test certifications.

3.4 ENGINEER SITE VISIT REPORTS

A. Engineer site visit reports will be furnished during construction as requested by the Architect.

B. Contractor is responsible for correcting all construction items as noted and to respond in writing to all deficiencies as directed. Contractor shall contact Engineer immediately if there are any questions or conflicts after receipt of written site visit reports.

C. Furnish response to all punchlist items within 10 days of receipt of report indicating completion status to maintain timely, planned construction progress without delays or problems.

3.5 FINAL CLOSEOUT PROCEDURES

A. Contractor shall provide the following items at substantial completion of this project and furnish to the construction manager, Owner or Architect as directed:

1. Preliminary sprinkler systems test for all manual alarm devices.

2. Preliminary systems test of all electrical devices with Division 26 Electrical prior to schedule of final walk-through and testing of systems by Office of School Facilities (OSF) inspector.

3. Provide Owner operation and training seminar at project closeout. Set up time for meeting and instruct Owner personnel in the proper operation and maintenance of sprinkler systems.

4. Provide Owner digital files for sprinkler shop drawings *(to include all field revisions)*, calculations and data sheets for all components. Digital files shall be placed on CD or thumb drive as directed by the Engineer.

END OF SECTION 21 13 00

SECTION 22 05 00 - MECHANICAL, PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section 23 00 00 MECHANICAL, GENERAL applies to this section of the specifications. Refer to Plumbing drawings *(Shts P1)* for work and materials for this section of the specifications.

1. Furnish products, materials and equipment as specified herein. Manufacturers and products or materials which are not indicated on drawings or specified will not be accepted.

2. *Refer to 10 day prior approval requirements for substitutions of plumbing equipment, materials, fixtures, fittings, valves, etc. as specified below*.

3. Private label products such as distributed by ProFlo, Brigade, Mainline, etc. will not be accepted as substitution for specified manufacturers for this project.

4. Failure to comply with specifications regarding Prior Approval will require replacement of all materials and products which are not listed in these specifications.

5. Contractor shall order all accepted products and materials immediately after receipt of Engineer shop drawing review comments to insure timely delivery without construction delays. See specifications 3.7 Submittals para. B.3 as applicable.

6. All products and materials for use in potable water systems shall meet Federal Public Law 111-380 (The Reduction of Lead in Drinking Water Act) effective January 04, 2014. This information shall be furnished on all product submittal data for engineer review prior to start of construction.

1.2 GENERAL

A. Before construction of project starts, check locations and inverts of existing and proposed pipes, sewers, storm drains, mains and points of connection to existing utilities. Report to Architect before start of construction any unsatisfactory condition or conflict between plumbing and any other trades. *No extra charge will be approved after start of construction from failure to follow these instructions*.

B. All work and materials shall comply with the IPC International Plumbing Code, IBC International Building Code, 2018 editions and all applicable local codes and ordinances.

1. All insulation products and installations shall comply with ASHRAE 90.1, latest edition.

C. Installation of Plumbing equipment and systems shall be in accordance with the requirements for Seismic of the IBC International Building Code.

D. Protect fixtures, materials and equipment from theft or against damage. Seal pipe and drain openings by test plugs or rubber “Gem” caps secured with stainless steel bands to prevent debris from being introduced into the drainage system.

1. Duct tape or PVC caps will not be permitted to seal soil, waste, drain or vent pipe openings.

E. Contractor shall verify and coordinate the exact locations and inverts of the underground sewer, water and roof drain lines and the connections to the utilities serving this site prior to start of construction. *It is extremely important that these locations and inverts are verified at the start of this project to prevent any conflicts during construction*. F. Fees for construction permits shall be included.

1.3 **SCOPE**

A. Provide all related equipment, labor, materials, and operations and accessories required for the installation of complete and quietly operating plumbing systems as indicated in accordance with the plans and specifications. This shall include the following:

! Roof Drain Piping
! Pipe Insulation
! Pipe Caulking Materials
! Pipe Hangers and Supports including Seismic Shop Drgs
! Pipe Sleeves
! Cleanouts
! Roof Drains
! Downspout Boots
! Tests
! Plumbing Submittal Data
! Project Record Drawings
! Plumbing Maintenance Manuals
! VideoTape of Underslab Piping
! Smoke Testing

1.4 **ALTERNATES**

A. Refer to the Architectural drawings, specifications and addenda for descriptions of all Alternates by the Architect as they apply to Division 22 Mechanical, Plumbing.

B. It shall be the responsibility of the contractor to coordinate all Plumbing work under Alternates and to notify the Engineer prior to bid date if any discrepancies occur concerning the Alternates or if any clarification of work under Alternates is required. No extra charge will be approved after start of construction from failure to follow these instructions.

1.5 **CONSTRUCTION PHASING**

A. Coordinate all construction with the Architect, Construction Manager, Owner and General Contractor prior to starting any work. Phasing of work relating to Plumbing shall be closely coordinated to prevent problems. Notify Engineer/Architect prior to starting work if any problems exist concerning phasing of work.

PART 2 - PRODUCTS

2.1 ROOF DRAIN PIPING

A. Run roof drain piping below grade to points 5'-0" beyond building and provide connection to storm drain piping approximately where shown on drawings.

1. Coordinate with existing conditions, Civil and Architectural drawings prior to start of construction.

B. Below Slab/Grade: Piping below finished floor slab or grade only shall be sch 40 solid core PVC plastic pipe and fittings. PVC pipe and fittings shall be in accordance with ASTM D-1785 and ASTM D-2665. PVC plastic pipe and fittings are not permitted above floor slab. Terminate PVC pipe at slab to permit installation of No-Hub transition couplings tight to floor slab.

1. Cellular core PVC plastic pipe is not permitted for use on this project.

2. Contractor shall provide a single manufacturer of PVC pipe and fittings on this project. Multiple manufacturers will not be accepted.

C. Above Slab: Piping located above finished floor slab shall be cast iron, hubless pipe with NoHub fittings. Pipe and fittings shall be in accordance with ASTM A-74 and WW-P-401d.

1. Provide long sweep bends for all vent and drain fittings in lieu of short sweep bends during installation of piping to avoid installing couplings partially imbedded in walls.

2. Cast iron pipe and fittings shall be as manufactured by Charlotte Pipe and Foundry or Tyler Pipe and shall bear the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International.

D. Joints and Connections:

1. Joints for plastic piping systems shall be made with sch 40 PVC plastic fittings with solventcement joints in accordance with ASTM D-2855. All plastic piping and joints shall be cleaned and moisture free prior to installation. All joints shall be wiped with an approved purple primer in accordance with ASTM F-656 or a primer conforming to ASTM D-2564.

2. Joints for No-hub piping shall be made with No-Hub fittings furnished with neoprene sleeves and band couplings. Standard No-Hub couplings will not be permitted. Couplings shall be heavy duty as follows:

Clamp-All Corporation: Clamp-All Hi-Torq 125 coupling
Anaheim Foundry: Husky “Orange” SD-4000 coupling
Note: *Contractor shall use caution in layout and installation of piping systems as required to avoid installation of mechanical couplings partially in walls. This is to avoid problems with installation of thru-wall pipe penetration materials at rated assemblies and to maintain integrity of UL/FM fire safing thruout the project. (School Facilities requires the use of rated “collars” to cover partially imbedded mechanical couplings.)*

3. Failure to comply with specifications will require removal and replacement of all unaccepted joint materials.

2.2 PIPE INSULATION

A. All insulation material shall have a fire hazard classification not to exceed flame spread of 25 and smoke developed rating of 50, as listed by Underwriters Laboratories and acceptable under NFPA Standards. This is to apply to the complete system and to the composite insulation with jacket or facings, vapor barrier, joint sealing tapes or coverings, mastic and fittings.

B. Pipe insulation shall be applied by an insulation contractor whose sole source of income is from the installation of commercial pipe insulating systems. Insulation shall be installed in strict accordance with manufacturer's recommendations.

1. *Furnish letter from Insulation Contractor with product submittal data at start of project*.

C. Above ground horizontal roof drain piping shall be insulated with 1" thick one piece fiberglass insulation with ASJ embossed vapor barrier laminated jacket.

1. Coordinate installation of pipe insulation with galvanized sheet metal insulation shields at clevis hangers to protect insulation from damage.

D. Pipe fittings shall be insulated with same material and thickness as pipe. Insulation shall conform to HH-1-558B, Form D, Type III, Class 12; NFPA 90A and MIL-1-223. Butt and seal all joints using coatings and adhesives as recommended by the insulation manufacturer.

E. Vertical roof drain piping located in chase may be insulated with 1/2" thick fiberglass, Polymer Foam (EPFI) or flexible unicellular insulation in lieu of the 1" fiberglass specified above. *Flexible unicellular insulation will not be permitted for pipe insulation located in areas above ceilings, in equipment rooms or where exposed.*

1. Butt and seal all joints using coatings and adhesives as recommended by the insulation manufacturer.

2. Maintain insulation complete for pipe penetrations through walls.

F. Insulate bodies of roof drains with 2" fiberglass blanket insulation sealed to underside of drain bodies and roof deck.

2.3 PIPE SUPPORTS

A. Perforated strap hangers, chain or wire will not be permitted on the job. All pipe hangers and supports shall be as required to meet Seismic requirements of the IBC International Building Code.

1. *Note: Installation of "Uni-strut" or pipe support channel systems will not be permitted for installation of pipe systems*.

2. Installation of hangers for all piping shall be suspended from building structures or supplementary steel as specified. Piping secured in corridors to walls with stand-off brackets is not permitted.

B. Support horizontal piping above ground with hangers, threaded rods and turnbuckles as manufactured by M-CO Michigan Hanger, Anvil, PHD Hangers, Holdrite or accepted equal.

1. ERICO hammer-on rod clips and Z purlin rod clips for 3/8" diameter rods will be accepted for suspended pipe sizes up to 2" in accordance with manufacturer instructions.

C. Support cast iron pipe with steel clevis hangers, spaced not over 5 feet apart for 5 foot sections of pipe and 10 feet apart for 10 foot sections. Locate hangers as near as possible to hubs or band connections.

1. Provide galvanized sheet metal insulation shields at clevis hangers to protect insulation from damage.

D. Provide concrete inserts for hanging pipe from concrete structures. Inserts shall permit adjustment, removal and use of different size hanger rods.

1. Contractor shall comply with the International Building Code for concrete anchors located in “Cracked Concrete”.

E. Provide supplementary steel required for proper support of suspended piping and installation of pipe hangers. All supplementary steel support bracing shall meet seismic design constraints.

1. Seismic systems as manufactured by Amber/Booth or Mason Industries will be accepted.

2. Provide acceptance letter from the manufacturer’s agent prior to project closeout indicating manufacturer review of installed seismic piping restraint systems throughout project.

Shop Drawings: Design of supports will require installation shop drawings furnished by the manufacturer which shall include installation methods, sizes and materials signed and sealed by a registered professional engineer in the State of South Carolina. Contractor shall furnish shop drawings for Engineer review at start of project.

2.4 PIPE SLEEVES

A. Core holes where all pipes pass through solid block wall construction, sized to allow clearance entirely around the passing pipe in accordance with seismic requirements of the International Building Code.

1. Provide pipe sleeves in walls for all piping penetrations. Pipe sleeves shall be made of Sch 40 steel or service weight cast iron pipe. Extend vertical sleeves a minimum of 1" above finished floor. Install all pipe sleeves in a waterproof manner.

2. Insulation shall be continuous through pipe sleeve except for rated or smoke wall penetrations as noted below and detailed on drgs.

3. Maintain openings in all walls as required to meet seismic penetration guidelines.

4. See Architectural drawings for locations of smoke walls. Contractor shall fill the space between the pipe and the opening by tightly packing with rock wool to maintain a positive smoke seal for entire penetration.

B. See Architectural drawings for locations of fire rated assemblies. Provide pipe sleeves where pipes pass through fire-rated walls or floors. The space between the pipe and the pipe sleeve shall

be filled with a UL rated through wall penetration system fire proofing material. Install in accordance with the manufacturer's specific instructions. Installation of fire stopping and sealing of all penetrations is included in this section of these specifications.

1. Failure to comply will require the removal of caulking materials and replacement with UL fire rated materials and sleeves as specified. Submit data sheets for caulking materials for Engineer review. See Architectural drawings for wall ratings and locations.

2. *See detail on drawings for applicable UL penetration assemblies*.

3. Sleeves in walls and floors shall be made of Sch 40 steel or service weight cast iron pipe.

4. Openings shall not be excessively large and/or irregular for efficient fire stopping details. All firestopping throughout the building shall utilize the same manufacturer's products to ensure compatibility and consistency of penetration seals. Coordinate with the general Contractor and other trades prior to beginning firestopping work. See Section 07 84 00 **Firestopping and Smoke Seals** for additional requirements.

C. Maintain sleeves throughout project with sleeves grouted neatly in place after installation. Coordinate grouting with general contractor as required.

2.6 PIPE CLEANOUTS

A. Cleanouts as follows by Zurn. Equal cleanouts by J.R. Smith or Josam will be accepted. Provide brass cleanout plugs for all cleanouts.

1. PVC plastic cleanouts will not be permitted inside building.

2. Contractor shall lubricate/grease all cleanout plugs prior to installation. B.

Cleanouts:

Floors (FCO): ZN-1400-BP-NL, with round scoriated nickle-bronze adjustable floor cover and neoprene gasket seal connection. Install top of cover flush with finish floor.

Grade (GCO): Sch 40 PVC with countersunk plastic plug. *(See detail on drawings for installation requirements)*

Wall (WCO): Z-1445-BP cleanout tee with bronze plug and ZN-1462 nickle bronze secured wall access panel and frame, size as required. Secure cleanout cover to wall using inside anchor lugs. Install flush with finished wall surface. *Coordinate size of opening with masonry contractor and provide wood blocking as temporary frame during construction of block walls.*

1. Maintain flush installation with all wall surfaces. Caulk access frames neatly after final painting of walls by the general contractor has been completed.

C. Provide (CM) carpet cleanout markers for all floor cleanouts located in carpeted areas. Coordinate installation of cleanouts with general contractor for installation of cleanout flush with finished floor slab prior to installation of carpet.
   1. Finished carpet shall be installed over top of cleanout. Do not cut carpet around floor cleanouts.

D. Contractor shall refer to detail on drawings for installation of exterior grade cleanouts.

   1. Precast concrete valve marker rings are not acceptable for use on this project. Provide poured-in-place concrete pads as detailed on drgs.

2.7 ROOF DRAINS

A. Installation and flashing of roof drains shall be under another section of these specifications.

B. Roof Drain (RD): Zurn ZC-100-G-DP-DR galvanized cast iron body drain with top-set deck plate, adjustable galvanized Top-Set Drain Riser and cast iron dome strainer, 4" outlet.

   1. Height of adjustment shall be field verified/coordinated with roofing contractor as required. Provide all materials as required for installation of drain riser and as required to permit installation of flashing by others.

   2. Equal roof drains as manufactured by Froet, Josam or J.R. Smith will be accepted.

C. Failure to closely coordinate the installation requirements for all roof drains with the respective trades will not relieve the contractor from the responsibility to furnish and install all necessary products to maintain installation in strict adherence to mfr's installation instructions.

2.8 DOWNSPOUT BOOTS

A. Provide J.R. Hoe 90 Degree cast iron downspout boots with 4" outlets where indicated on drawings. Length of downspout boots shall be minimum 30".
DSB : 3"x4" rectangular inlet opening, 4" dia horizontal outlet. *Verify inlet opening sizes with Architectural drgs prior to ordering downspouts to prevent conflicts.*

B. Coordinate installation of downspout boots with Architectural drawings as required to prevent conflicts. Install top of downspout boot 15" above finished slab or grade as directed. *See detail on drawings and provide all materials as indicated.*

C. *Painting of downspout boots shall be under another section of these specifications*.

D. Equal 1-piece stainless steel powdercoated downspout boots as manufactured by Piedmont Pipe Downspout Adaptors will be accepted. Piedmont Pipe Downspout Adaptors shall be furnished with with collars to match downspout inlet size. Color of boot to match downspout.

PART 3 - EXECUTION

3.1 SEISMIC RESTRAINT

A. Seismically restrain all piping as directed by seismic engineer per paragraph 2.3E of these specifications. Provide all necessary materials for installation of seismic restraint systems. All systems components, methods of installation and materials shall be furnished by the seismic system manufacturer and shall be installed in strict accordance with seismic engineer details and instructions.

B. Seismic supplier shall provide review and certification for installation of seismic components during construction and furnish written report after installation of seismic components are complete. Review and certification letter shall be certified by registered professional engineer and shall be furnished on manufacturer letterhead.

C. Contractor shall reference Architectural and structural drgs for all seismic data as applicable.

1. If seismic restraint is not required due to the project location, the plumbing contractor shall provide a letter on seismic engineer's letterhead stating seismic restraint is not required. Letter shall contain seismic engineer's seal and signature and shall be part of Owner's closeout documents at project completion.

3.2 ROOF DRAIN PIPE

A. Run horizontal pipe, graded uniformly, not less than 1/4" per foot for pipes 3" and smaller and 1/8" per foot for larger pipes. Offset to pass obstructions.

B. Change size by reducing fittings. Change directions by using 45 degree wyes and long-sweep bends. No pipe to be drilled, tapped or welded. Saddle hubs, tapped tees, and crosses will not be permitted.

C. Each section of roof drain pipe shall be laid to the specified line and grade, working in the upstream direction with the bell end laid upgrade.

3.3 TESTS

A. Test roof drainage pipe systems by plugging all necessary openings and filling systems with minimum 10'-0" water column, or to the top of the highest vent stack.

B. Notify local authorities and Engineer prior to backfill of all underground roof drain lines. Failure to comply shall require lines to be uncovered, retested and inspected.

3.4 VIDEO TAPING OF SEWER AND WASTE LINES

A. Contractor shall provide video camera recording of all underslab drain lines prior to final acceptance of below grade drain systems. Contractor is instructed to coordinate scheduling of video taping of underground lines with the construction manager, Special Inspector and School District and schedule these sessions as directed.

1. Discovery of any blockages or problems relating to the improper installation of underground drain lines shall be corrected by the contractor prior to final acceptance of this work.

2. Contractor shall provide pressure cleaning and flushing of underslab piping systems including grease traps and dilution basins prior to building acceptance.

3.5 SUBMITTAL DATA REQUIREMENTS

A. Submit detailed shop drawings, equipment material cut sheets, and product data for all plumbing materials, products and accessories as listed below. Product data shall be submitted immediately after award of contract.

1. Partial submission of materials and products or electronic submission of data will not be accepted.

2. Place submittal data in hard 3-ring binder and include engineer's list of specified products at front of data book clearly marked indicating all submitted items. Number of submittal data books required for review shall be determined by the Architect.

3. **Provide minimum (1) complete set to the Engineer for Preliminary Review of all products for this product as directed. *This preliminary copy of all plumbing products shall remain with the Engineer after review comments have been furnished to the Architect.***

4. **Partial** data books submitted for review will be **REJECTED** and will not be reviewed or returned to the contractor. Contractor shall resubmit incomplete data books that are not in compliance with specifications to enable Engineer review.

5. Contractor shall furnish additional data for products and materials for Engineer review in accordance with Preliminary Review Comments as directed.

B. **Contractor shall order all materials after receipt of completed/reviewed shop drawings, equipment material cut sheets, and product data for Plumbing systems to insure timely delivery to project once materials and equipment have been accepted**.

1. Delays in delivery of the aforementioned products for this project will not be tolerated.

2. Substitutions of lessor products than specified will not be accepted due to delays in delivery by the supplier or manufacturer.

3. Failure to comply will require the installation of temporary materials and products as directed by the Engineer to permit completion of the job without delay. These temporary products shall be replaced at the contractors expense once specified materials and products are received.

C. Products and materials required for engineer review are as follows:

! Pipe Materials
! Pipe Jointing Materials
! Pipe Insulation with Installer Letter
! Fire Caulking Materials
! Pipe Hangers and Supports including Seismic Shop Drgs
! Cleanouts
! Roof Drains
! Downspout Boots

3.6 ENGINEER SITE VISIT REPORTS

A. Engineer site visit reports will be furnished during construction as requested by the Architect.
B. Contractor is responsible for correcting all construction items as noted and to respond in writing to all deficiencies as directed. Contractor shall contact Engineer immediately if there are any questions or conflicts after receipt of written site visit reports.

C. Furnish response to all punchlist items within 10 days of receipt of report indicating completion status to maintain timely, planned construction progress without delays or problems.

3.7 FINAL CLOSEOUT PROCEDURES

A. Contractor shall provide the following items at completion of this project and furnish to the construction manager, Owner or Architect as directed:

1. Minimum (2) copies of completed product submittal data. This shall include warranties and maintenance manuals for electric water coolers, etc.

2. Videotape copies for all underslab drain piping systems.

3. Seismic installation and certification letter from the seismic engineer/supplier.

END OF SECTION 22 05 00

SECTION 23 00 00 MECHANICAL GENERAL

PART 1 - GENERAL

1.1 The provisions of the GENERAL CONDITIONS OF THE CONTRACT, the SUPPLEMENTARY CONDITIONS, and Section 23 00 00 Mechanical General of the Specifications, apply to the work under this Section to the same extent as if fully included herein.

1.2 All material and work shall comply with the National Fire Codes of the NFPA, National and local codes and the ICC International Code Council, Building, Mechanical, Plumbing and Gas Codes 2018 editions and 2009 International Energy Code. Mounting heights of devises shall be in accordance with ADA, ANSI A117.1 2017 Addition.

1.3 CONTRACT DOCUMENTS

A. Drawings for work under this Division of the specifications indicate generally the location, arrangement and intent of the systems to be installed. Although they are to some extent diagrammatic, they are to be followed as closely as possible. If due to job conditions, for coordination of other trades, or for other reasons it is found necessary to change the location of items, such changes shall be made without additional cost to the Owner and as reviewed by the Architect. Provide all offsets, fittings, etc., without extra charge.

B. It is not the intent of these documents to be used as installation drawings nor to include all related services or accessories to place systems in operation. Installation of equipment shall be in strict accordance with the respective manufacturer's recommended instructions. Obtain certified drawings and installation instructions before starting work. The systems shall operate safe, quietly and in the opinion of the Architect, excellent condition.

1.4 It is the intent of these plans and specifications to describe a complete and working HVAC system and to prescribe for the complete installation and testing of the equipment and devices specified under other sections of the specifications or on the drawings. Work under this Division of the contract includes all work necessary to make equipment and systems operational while following the details of the drawings and specifications as close as possible. When additional items are required to make systems operational, and are not specifically specified, then items shall be in accordance with the manufacturer's recommendations for the applicable conditions encountered.

1.5 ELECTRICAL CONNECTIONS

A. Temperature and equipment control wiring are included under this Division of the contract. All starters not factory-mounted shall be furnished under this Division and installed (including wiring through starters) under "Electrical" Division of the contract. Starters shall be generally furnished by the equipment manufacturer specifically for each piece of equipment. Overload heaters in all starters and in ungrounded conductors are included in this Division of the contract.

B. Motor starters shall be furnished by the mechanical contractor and delivered to the electrical contractor for mounting and power connections through starter to motor. The contractor shall furnish starters, or combination starter/disconnects as shown on the electrical drawings. Refer to the electrical drawings for the type required for each piece of equipment. Mounting and wiring of starters including wiring to equipment shall be provided under electrical section of the specifications.

1.6 SEISMIC REQUIREMENTS

A. All Plumbing and HVAC materials and installation shall comply with the latest ICC International Code Council Mechanical Code with the latest revisions for applicable seismic zone protection.

B. See other sections in Division 23 for more specific specifications. Generally, the seismic requirements are covered in the sections where they apply (example: Seismic restraints for ductwork are in section 23 05 48 Mechanical, Ductwork).

1.7 COMMISSIONING/FINAL CHECK-OUT (HVAC)

A. The contractor shall provide all coordination, submittal data and shop drawing information to comply with the commissioning requirements as specified. Commissioning is the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent. The commissioning process shall begin no later than the bid phase and continue through the two year warranty period.

B. The testing and balancing contractor in conjunction with the mechanical contractor and controls contractor shall submit a statement to the Engineer that check test and start-up has been successfully completed and that all equipment, systems and controls are complete and ready for functional performance testing.

C. The testing and balancing contractor, controls contractor and mechanical contractor shall work closely for verification of the HVAC system and all components throughout project construction. A report issued by the T&B contractor shall test the dynamic function and operation of equipment and systems executed by the Contractor. Systems are tested shall be various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are run through all specified sequences of operation. Components are verified to be responding in accordance with Contract Documents. Functional Performance Tests are executed after start-ups and Pre-functional Checklists are complete.

1.8 COORDINATION SHOP DRAWINGS

A. The General/Electrical/Plumbing contractor shall coordinate and assist the Mechanical contractor in preparation of detailed coordination shop drawings for all systems. Drawings shall be prepared to carefully coordinate with architectural, plumbing, sprinkler, electrical and structural drawings regarding elevation, access, serviceability and replacement of systems. Space priorities shall be coordinated and established with each trade prior to beginning work to prevent field conflicts. No extra payments for changes or modifications will be allowed any contractor where work has begun without fully coordinated shop drawings. A completed set of coordinated shop drawings shall be submitted to the Design Team for review prior to beginning any work or ordering of any associated equipment, piping, wiring, steel, fixtures, conduits, etc.

B. Each trade contractor shall coordinate its construction operations and space requirements with those of other contractors and entities to ensure efficient and orderly installation of each trade. These parameters shall be incorporated into the shop drawings developed to identify and resolve any potential conflicts prior to project construction.

C. Coordination meetings shall be held with the general contractor and MEP contractors at the beginning of the project and prior to start of construction in any area, to development the coordination drawings and resolve potential installation conflicts. Coordination meetings for the purpose of producing coordinated shop drawings shall be scheduled by area(s) and held during drawing development and shall continue through project completion. Coordination shall include:

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before, during or after its own installation.

2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required for maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for any installation phase including known future work.

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical, electrical and plumbing.

5. Where conflicts arise during the coordination or construction phase, the construction team shall identify conflicts and present cost effective solutions to accompany RFI's to the design team for review and issuance of directive resolution measures.

D. Shop drawings shall show the routing of all water piping, supply, return, exhaust and fresh air ductwork closely following the contract drawings and specifications. Drawings shall be detailed to miss any structural elements and work of all other trades and shall include the following as a minimum:

1. HVAC All necessary heating, ventilating, air-conditioning and specialty equipment, including air handlers, pumps, piping, air distribution ducts for supply, return, and ventilation and exhaust ducts, including control system, registers, diffusers, grills necessary to produce accurate plans, elevations, building/wall sections and schedules. All piping larger than 1.5" diameter shall be modeled.

2. PLUMBING All necessary plumbing piping and fixture layouts, floor and area drains, and related equipment, necessary to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules. All piping larger than 1.5" diameter shall be modeled.

3. ELECTRICAL All necessary interior electrical components (i.e., lighting, receptacles, special and general purpose power receptacles, lighting fixtures, control systems), necessary to produce accurate plans, details and schedules. Cable tray routing shall be modeled without detail of cable contents.

E. Ductwork drawings shall show size, length of each piece, top and bottom elevations and placement of registers and grilles. Fittings shall also show throat length or radius, amount of rise or fall and amount of offset. All riser ducts shall be shown where indicated on drawings. Shaft ducts shall be detailed and fully dimensioned.

F. Drawings shall detail exact placement of all HVAC equipment and shall define access and service area required for each piece of equipment. Pad drawings of air handling units if required shall also be included and fully detailed.

1.9 FIRE STOPPING AND SMOKE SEALS

The Mechanical Contractor shall be responsible for installing fire stopping and joint seals as required for the work in this section. All penetrations through fire resistive construction shall be sealed in accordance with UL drawings and Fire Stop specifications. Products used for fire stopping shall be by the same manufacturer throughout the building for all trades. Coordinate fire stopping work with the General Contractor and all other trades.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. All requests for substitutions shall be submitted in writing so as to be received by the Engineer at least ten (10) calendar days prior to bid date and must be granted permission to quote before award of contract.

B. Requests for approvals shall be submitted in the form of a letter (with one copy minimum) on letterhead of submitting firm. Letter to be addressed to the Engineer and referenced to this job.

C. Permission to substitute items shall not be construed as authorizing any deviations from the contract documents, unless such deviations are clearly indicated in letter form. Contractor shall be responsible for verifying all dimensions with available space conditions (with provisions for proper access, maintenance, part replacement and for coordination of other trades) for proper services and construction requirements. Contractor to bear any additional costs for required changes in associated items which are directly or indirectly related to a substituted item.

2.2 MATERIAL AND EQUIPMENT SUBMITTALS

A. The Engineer will review and take appropriate action on equipment submittals, product data, samples, and other submittals required by the Contract Documents. Such review shall be only for general compliance with the design and with the information given in the Contract Documents.

B. All submittals of equipment and materials for this project shall be furnished by the manufacturer's local representative for Mechanical Design, Inc. No submittals will be received where the local representative has not originated or reviewed the submittal prior to submission. All non compliant submittals will be promptly rejected.

C. Prior to submittal of equipment submittals to the Architect, Contractor shall review and approve equipment submittals. Equipment submittals which have not been reviewed and approved in writing by the Contractor will not be reviewed by the Engineer.

D. The Contractor shall submit for review by the Architect detailed drawings of all equipment and all material listed in this section. All submittal data shall be bound a hardback binder. Partial submittals will not be reviewed by the Engineer. The Contractor shall furnish six (6) copies of equipment submittals.

E. Equipment submitted for review shall be detailed, dimensioned drawings or catalog pages showing construction, size, arrangement, operating clearances, performance characteristics and capacities.

F. It shall be the sole responsibility of the Mechanical Contractor to verify and coordinate electrical voltage supplied to all mechanical equipment prior to placing equipment order. Prior to ordering equipment, the mechanical contractor shall submit in writing a list of all mechanical equipment and voltages of each to the electrical contractor and electrical engineer for their review. The mechanical contractor shall include a copy of this letter in the equipment submittal package.

G. Review rendered on equipment submittals shall not be considered as a guarantee of measurements of building conditions. WHERE DRAWINGS ARE REVIEWED, SAID REVIEW DOES NOT MEAN THAT DRAWINGS HAVE BEEN CHECKED IN DETAIL; SAID REVIEW DOES NOT IN ANY WAY RELIEVE THE CONTRACTOR FROM HIS RESPONSIBILITY OR NECESSITY OF FURNISHING MATERIAL OR PERFORMING WORK AS REQUIRED BY THE CONTRACT DOCUMENTS.

H. The Contractor shall submit equipment submittals for the following materials and equipment for review by the Engineer:

- Test and Balance
- Mechanical Insulation (including closure system)
- Duct Systems (including closure system)
- Duct coordination drawings
- Air Distribution
- Packaged Rooftop Units
- Seismic (with calculations)
- Controls

2.3 FINISHES

Contractor shall furnish to Architect color chart, etc. as required for him to select finishes for any piece of equipment, grilles, diffusers, exposed ductwork and piping. Color charts shall be submitted with submittal data. All finishes shall be equivalent to baked enamel unless otherwise indicated

PART 3 – EXECUTION

3.1 SITE CONDITIONS

All bidders shall visit the site and become familiar with all existing conditions before submitting a bid. No extra payments will be made for incidental work not specifically called for but which is necessary for the delivery or proper installation of equipment and functioning of the systems as specified in the bid documents. Submission of a bid will be considered as evidence that this has been done, and no extra payments will be allowed the Contractor because of extra work made necessary by his failure to do so.

3.2 Contractor shall deliver to owner a complete, fully operational system. All items to be properly lubricated and operate to their full extent upon completion of the project.

3.3 CONTRACT DOCUMENTS

After thorough examination of contract documents, Contractor shall bring to attention of Architect prior to bid time any discrepancies, errors or omissions in this Division.

3.4 CERTIFICATES AND CODES

Contractor shall deliver to Architect any certificates, permits and licenses as required to comply with all City, County and State applicable laws, ordinances, codes, rules and regulations, including any certificates required by fire department. If any of these items are requested, such items shall be furnished prior to final inspection.

3.5 WORKMANSHIP

All work included in this contract shall be performed by skilled people under competent supervision employing the latest and best practices of the various trades involved. All materials and equipment hereinafter specified shall be new and free from flaws and defects of any nature. Work that is not of good quality will require removal and reinstallation.

3.6 COORDINATION

A. No work shall be performed, or equipment may be ordered on this project before thoroughly coordinating all space requirements for equipment, ducts, pipes, conduits, etc. with all trades concerned. Establish necessary tie-ins for each trade. No equipment shall be ordered for this project

before thoroughly coordinating with all trades the type required for proper installation of equipment in roof, walls and ceiling assembly.

B. Prior to starting installation, furnish to all trades concerned copies of reviewed shop drawings showings location of equipment, piping, ductwork, etc.

C. Schedule periodic meetings with other trades before and during installation to avoid conflicts and assure that equipment, piping, ductwork, etc. are installed in the best manner, taking into consideration head-room, maintenance, appearance, replacement and space requirements.

D. The responsibility for obtaining, cutting, patching, excavating, and backfilling for work under this section of the specifications is included under this section of the specifications.

E. Contractor shall coordinate the exact size and location of all construction openings with the proper trades preparing the openings and be responsible for obtaining sizes as required. Openings for equipment shall be in accordance with the manufacturer's certified drawings. Lintels shall not be included in this section of the contract.

F. It shall be the sole responsibility of the Mechanical Contractor to verify and coordinate electrical voltage supplied to all mechanical equipment prior to placing equipment order. Prior to ordering equipment, the mechanical contractor shall submit in writing a list of all mechanical equipment and voltages of each to the electrical contractor and electrical engineer for their review. The mechanical contractor shall include a copy of this letter in the equipment submittal package. Power wiring and mounting of starters and all control components required to install power wiring are not included in this section of the contract. Contractor shall provide adequate wiring diagrams to any trade concerned.

G. Roof curbs as shown on the Mechanical drawings shall be furnished under this section of the specifications. Curb caps for weather proofing prior to setting of equipment shall also be furnished under this section of the specifications. The installation of roof curbs is not included in this section of the specifications.

H. Painting of equipment, piping and ductwork for shall be included in this section of the specifications.

3.7 Contractor shall be responsible for the protection and cleanliness of equipment installed under this section of the contract.

3.8 INSPECTION OF CONCEALED WORK

Contractor shall notify the Engineer at least three (3) day in advance prior to covering up or concealing any work under this division of the contract. Any work covered or concealed without consent or review of the Engineer shall be exposed for examination at the Contractor's expense.

3.9 DAMAGES DURING CONSTRUCTION

Contractor shall be responsible for any costs of repairing any damages caused by this contractor, to the building, building contents, and site during construction and guarantee period.

3.10 CUTTING AND PATCHING

Provide all cutting and patching necessary to install the work specified in this section. Provide inserts, sleeves, access panels, supports, etc. Lay out work in advance and establish locations of chases, inserts, sleeves, access panels, etc.

3.11 EXCAVATION AND BACKFILLING

A. Provide all excavating and backfilling for work under this Division of the contract.

B. Install sewer and water pipes in separate trenches, graded uniformly to provide solid bearing and required fall. Dig bell holes at hubs. Remove rock for one (1) foot below pipe and replace with sand.

C. Upon completion of tests and inspections, backfill with approved material, placed and tamped to prevent excessive settlement.

3.12 OWNER INSTRUCTION

A. Contractor shall instruct the Owner's representative in complete detail as to proper operation of the overall system. Advise the Owner as to where to order common replacement items. Deliver to the Owner the equipment manufacturer agent's name, address, and telephone number for each piece of equipment.

B. Provide two copies of a hard back three-ring file folder containing all warranties, catalog data and the manufacturer's standard operating and maintenance instructions for each item of equipment.

C. The folder shall also contain a maintenance sheet for each piece of equipment, type written by the contractor. Each sheet shall list the maintenance functions to be performed in accordance with the manufacturer's recommendations and the frequency with which each is to be done.
Provide columns on each sheet so that they may be dated by maintenance personnel when each individual function is performed. The contractor shall instruct and demonstrate each maintenance function to the Owner's representative.

3.13 FINAL INSPECTION

A. Contractor shall provide all initial balancing that season conditions will allow prior to final inspection.

B. For final inspection, all construction filters shall be replaced with new filters. All items shall be cleaned thoroughly inside and outside of all dust, dirt, plaster or other foreign material. Repainting of scratched equipment shall be completed.

C. Contractor shall notify the Architect, Engineer and or construction manager in writing that he has complied with the above items prior to final inspection. In addition the contractor shall furnish a statement prior to OSF inspection the following items are complete:

- All smoke detectors are installed and working properly.
- All penetrations (pipes, conduit, ducts, etc.) in rated walls and/or floor/ceiling assemblies are properly installed using appropriate methods and materials.
- All required seismic bracing of walls, equipment, pipes and ducts is present and properly installed.
- All HVAC systems have been tested, balanced, and commissioned per ASHRAE 90.1. A copy of the report will be available at the inspection.
- Listed assembly details, product data sheets, and approved submittals are available on site.

D. A mechanic shall be present at final inspection with all tools and instruments required to completely inspect and check measurements required under "Testing and Balancing." Provide a stepladder and keys for control instruments.

E. Contractor shall indicate in red ink on prints all changes to underground services. Submit print along with other submittals required prior to final inspection.

3.14 GUARANTEE

A. Contractor shall guarantee all equipment, ductwork, piping and any other materials specified under this Division of the contract for a period of one (1**)** year from the date of project acceptance unless otherwise indicated. Upon failure of any part(s) of the system during the guarantee period, the affected part(s) shall be repaired or replaced promptly by and at the expense of the Contractor.

B. If any component fails during the regular warranty period, then the replacement part(s) shall be given an additional one (1) year guarantee from the time of replacement. This shall continue until the items have given 1 year of satisfactory service.

3.15 IDENTIFICATION

Contractor shall identify each piece of equipment (except in finished areas) and each control device with its correct set point. Items shall be identified by name and numerical sequence (RTU-1, etc.). Nameplates shall be 1/16" thick plates with ½" high white letters on black background. Nameplates shall be attached securely. No identification shall be done until all painting has been accomplished. Locations for servicing equipment above ceilings shall also be labeled with nameplates attached to the ceiling grid identifying equipment and access location.

3.16 EQUIPMENT PAINTING

Contractor shall paint all new equipment (except factory painted equipment), ductwork, piping and any other materials exposed to view. New equipment, pipes, ductwork and other exposed materials shall be completely sanded, primed and repainted where factory paint has been scratched. Paint shall be as recommended by equipment manufacturer. Pipes shall be color coded with colors selected by the Engineer. Devoe, Sherwin Williams, Pittsburg, Glidden or approved equal paints may be used.

3.17 RECORD DRAWINGS

A. Contractor shall maintain on the job site one complete set of drawings for this project. All changes authorized by the Architect and/or Owner as to locations, sizes, etc. of equipment, ductwork, piping and other material shall be indicated in red ink on the drawings as work progresses.

B. Contractor shall obtain at his expense, a set of reproducible drawings on which he shall indicate the information outlined above, prior to final inspection. The Architect will make available to the Contractor original drawings of the work to be used to make the reproducible drawings. The final, annotated, reproducible drawings shall be turned over to the Architect at the time of final inspections.

3.18 UTILITY INTERRUPTIONS:

3.19 Obtain owner's approval for water utility interruptions at least five (5) working days in advance of all scheduled interruptions. Contractor shall arrange work so that interruptions are minimized in number and duration.

3.20 TEMPORARY AIR CONDITIONING

A. The Mechanical Contractor shall coordinate with the General Contractor the requirements for temporary air conditioning of the building for completion of interior finish work prior to substantial completion.

B. The mechanical Contractor shall schedule his work to provide temporary heating and cooling utilizing the new HVAC system at the request of the General Contractor. Service, maintenance and filter service of the equipment shall be provided by the Mechanical Contractor. The Mechanical contractor shall provide temporary duct filters to maintain a clean duct system during temporary service.

C. The use of the new HVAC system shall not decrease the equipment or installation warranty as specified herein. All equipment and installation warranties shall begin at substantial completion of work.

END OF SECTION 23 00 00

SECTION 23 05 48 VIBRATION ISOLATION AND SEISMIC RESTRAINT

PART 1 - GENERAL

1.1 The provisions of the GENERAL CONDITIONS OF THE CONTRACT, the SUPPLEMENTARY CONDITIONS, and Section 23 00 00 Mechanical General of the Specifications, apply to the work under this Section to the same extent as if fully included herein.

1.2 All equipment and materials for this project shall be purchased from and furnished to the contractor by the manufacturer's local representative for Mechanical Design, Inc. No submittals for equipment or materials will be received where the local representative has not originated the submittal data for this project. All non compliant submittals will be promptly rejected.

1.3 The seismic supplier shall provide a project site visit review, certification of installation of seismic components during construction and furnish a written report after installation of seismic components are complete. Site visit review and certification letter shall be completed by a manufacturer's representative in the employ of the seismic supplier with a minimum 5 years' experience. The certification letter shall be furnished on the manufacturer's representative letterhead and shall reference the original stamped seismic drawings/submittals.

1.4 See "EQUIPMENT ISOLATION AND SEISMIC SCHEDULE" at the end of this section for applicable specification requirements.

1.5 All mechanical equipment 3/4 HP and over listed in the Vibration Isolation / Seismic schedule shall be mounted on vibration isolators to prevent the transmission of objectionable vibration and vibration induced sound to the building structure. All isolation materials, flexible connectors and seismic restraints shall be of the same manufacturer.

1.6 Install full line size flexible pipe connectors at the inlet and outlet of each pump, cooling tower, condenser, chiller, coiling connections and where shown on the drawings. All connectors shall be suitable for use at the temperature, pressure, and service encountered. Flexible connectors shall not be required for suspended in-line pumps.

1.7 Unless otherwise specified, all mechanical, electrical, and plumbing equipment, pipe, and duct shall be restrained to resist seismic forces. Restraint devices shall be designed and selected to meet the seismic requirements as defined in the latest issue of the IBC or local jurisdiction building code.

1.8 Seismic restraint shall not be required for the following:

A. Hanging, wall mounted, and flexibly supported mechanical, plumbing and electrical components that weigh 20 pounds (89 N) or less, where I_p = 1.0 and flexible connections are provided between the components and associated duct work, piping and conduit.

B. Piping supported by individual clevis hangers where the distance, as measured from the top of the pipe to the supporting structure, is less than 12 inches for the entire pipe run and the pipe can accommodate the expected deflections. Trapeze or double rod hangers where the distance from the top of the trapeze or support to the structure is less than 12 inches for the entire run.

C. High deformability piping (steel, copper, aluminum with welded, brazed, ground, or screwed connections) designated as having an Ip = 1.5 and a nominal pipe size of 1 inch (25 mm) or

less where provisions are made to protect the piping from impact or to avoid the impact of larger piping or other mechanical equipment. Note, any combination of piping supported on a trapeze where the total weight exceeds 10 lb/ ft. must be braced.

D. High deformability piping (steel, copper, aluminum with welded, brazed, ground, or screwed connections) and limited deformability piping (cast iron, FRP, PVC) designated with an Ip = 1.0 and a nominal pipe size of 1 inch and less in the mechanical equipment room, or 2" and less outside the mechanical equipment room.

E. PVC or other plastic or fiberglass vent piping.

F. HVAC ducts suspended from hangers that are 12 inches or less in length from the top of the duct to the supporting structure and the hangers are detailed to avoid significant bending of the hangers and their connections. Duct must be positively attached to hanger with minimum #10 screws within 2" from the top of the duct.HVAC duct with an I_p = 1.5 that have a cross-section area less than 4 square feet. HVAC ducts with an I_P = 1.0 that have a cross sectional area of less than 6 square feet.

G. Equipment items installed in-line with the duct system (e.g, fans, heat exchangers and humidifiers) with an operating weight less than 76 pounds. Equipment must be rigidly attached to duct at inlet and outlet.

H. Manufacturer of vibration and seismic control products shall provide piping, ductwork and equipment isolation systems and seismic restraints as scheduled or specified with installation instructions and shop drawings for all materials supplied under this section of the specifications.

1.9 Submittals shall include calculations to determine restraint loads resulting from seismic forces presented in local building code or IBC, Chapter 16 latest edition. Seismic calculations shall be certified & stamped by an engineer in the employ of the seismic equipment manufacturer with a minimum 5 years' experience and licensed in the project's jurisdiction. Provide calculations for all floor or roof mounted equipment, and all suspended or wall mounted equipment 20lbs or greater.

1.10 Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. All bolts shall be ASTM A307 or better.

1.11 The isolators and seismic restraint systems listed herein are as manufactured by Amber / Booth, Mason Industries, Kinetics, or approved equals which meet all the requirements of the specifications, are acceptable. Manufacturer must be a member of the Vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

1.12 Steel components shall be cleaned and painted with industrial enamel. All nuts, bolts and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer.

1.13 All isolators, bases and seismic restraints exposed to the weather shall utilize cadmium plated, epoxy coat or PVC coated springs and hot dipped galvanized steel components. Nuts, bolts and washers may be zinc-electroplated. Isolators for outdoor mounted equipment shall provide adequate restraint for the greater of either wind loads required by local codes or withstand a minimum of 30 lb. / sq. ft. applied to any exposed surface of the equipment.

1.14 Provide shop drawings indicating location of all cable restraints required for pipe and ductwork. Drawings must be stamped by manufacturer's registered professional engineer. Mechanical, electrical and plumbing equipment manufacturers shall provide certification that their equipment is capable of resisting expected seismic loads without failure. Equipment manufacturers shall provide suitable attachment points and/or instructions for attaching seismic restraints.

PART 2 – PRODUCTS

2.1 **VIBRATION ISOLATORS**

A. Specification W: a pad type mounting consisting of two layers of ribbed elastomeric pads with a ½" poro-elastic vibration absorptive material bonded between them. Pads shall be Amber / Booth Type NRC.

B. Specification A: an elastomeric mounting having a steel baseplate with mounting holes and a threaded insert at top of the mounting for attaching equipment. All metal parts shall be completely embedded in the elastomeric material. Mountings shall be designed for approximately
½" deflection, and incorporate a steel seismic snubber with all directional restraint. Mountings shall be Amber/Booth Type SRVD.

C. Specification D: an elastomeric hanger consisting of a rectangular steel box capable of 200% minimum overload without visible deformation, 30 degree rod misalignment and an elastomeric isolation element designed for approximately ½" deflection. Hangers shall be Amber/Booth Type BRD.

D. Specification E: a combination spring and elastomeric hanger consisting of a rectangular steel box capable of 200% minimum overload without visible deformation, 30 degree rod misalignment, coil spring, spring retainers and elastomeric element designed for approximately ½" deflection. The spring shall be designed for a minimum kx/ky of 1.0. Spring hangers shall be Amber/Booth Type BSRA.

E. Specification F: a set (two or more) of spring thrust resisting assemblies, which consist of coil springs, spring retainer, isolation washer, angle mounting brackets, and elastomeric tubing for isolating thrust resister rod from fan discharge. Thrust restraints shall be Amber / Booth Type TRK.

F. Specification SB: a unitized adjustable open spring isolator and a welded steel housing designed to resist seismic forces in all directions. Restraint surfaces which engage under seismic motion shall be cushioned with a resilient elastomer to protect equipment. Restraints shall allow a maximum of 1/4" movement before engaging and shall allow for the spring to be changed if required. Isolator shall be a stable spring with a minimum ky/ky of 1.0. The spring package shall include an elastomeric pad for high frequency absorption at the base of the spring. Nuts and bolts shall be zinc-electroplated to prevent corrosion. Bolting equipment to isolator with bolts smaller than main adjusting bolt will not be allowed. Baseplate shall provide means for bolting to the structure. Entire assembly shall be rated to exceed the applied seismic load . Mountings shall be Amber/Booth Type SWSR.

2.2 **BASES**

A. Specification G: a welded integral structural steel fan and motor base with NEMA standard motor slide rails and holes drilled to receive the fan and motor slide rails. The steel members shall be adequately sized to prevent distortion and misalignment of the drive, and specifically,

shall be sized to limit deflection of the beam on the drive side to 0.05" due to starting torque. Snubbers to prevent excessive motion on starting or stopping shall be furnished if required; however, the snubbers shall not be engaged under steady running conditions. Bases shall be Amber/Booth Type SFB.

B. Specification H: a welded WF (main member) structural steel base for increasing rigidity of equipment mounted thereon or for unitizing belt driven fans. Fan bases shall have holes drilled to match fan and located to provide required center distance between fan and supplied NEMA standard motor slide rails. The steel members shall have minimum depth of 1/12" of the longest span, but not less than 6" deep. Junior beams and junior channels shall not be used. Cross members shall be provided where necessary to support the equipment or to prevent twisting of the main members. Where height restrictions prevent the use of members having a depth of 1/12 of the longest span, beams of less depth may be used provided they have equal rigidity. Provide
height-saving brackets for side mounting of the isolators. Brackets for use with Specification type B isolators having 2.5" deflection or greater shall be of the precompression type to limit exposed bolt length. Bases shall be Amber/Booth Type WSB.

C. Specification J: a concrete inertia base consisting of perimeter structural steel concrete pouring form (CPF), reinforcing bars welded in place, bolting templates with anchor bolts and heightsaving brackets for side mounting of the isolators. Brackets for use with Specification type B isolators having 2.5" deflection or greater shall be of the precompression type to limit exposed bolt length. The perimeter steel members shall have a minimum depth of 1/12 of the longest span, but not less than 6" deep. The base shall be sized with a minimum overlap of 4" around the base of the equipment and, in the case of belt-driven equipment, 4" beyond the end of the drive shaft. Fan bases are to be supplied with NEMA standard motor slide rails. The bases for pumps shall be sized to support the suction elbow of end suction pumps and both the suction and discharge elbows of horizontal split-case pumps. The bases shall be T-shaped where necessary to conserve space. Inertia bases shall be Amber/Booth Type CPF.

2.3 **SEISMIC RESTRAINTS:**

A. Specification SL: a restraint assembly for floor mounted equipment consisting of welded steel interlocking assemblies welded or bolted securely to the equipment or the equipment bases and to the supporting structure. Restraint assembly surfaces which engage under seismic motion shall be lined with a minimum ¼" thick resilient elastomeric pad to protect equipment. Restraints shall be field adjustable and be positioned for 1/4" clearance as required to prevent interference during normal operation. Restraint assembly shall have minimum rating of 2 times the catalog rating at 1 G as certified by independent laboratory test. Restraint shall be Amber/Booth Type ER.

B. Specification SC: a restraint assembly for suspended equipment, piping or ductwork consisting of high strength galvanized steel aircraft cable. Cable must have Underwriters Laboratories listed certified break strength and shall be color-coded for easy field verification. Secure cable to structure and to braced component through bracket or stake eye specifically designed to exceed cable restraint rated capacity. Cable must be manufactured to meet or exceed minimum materials and standard requirements per AISI Manual for structural applications of steel cables and ASTM A630. Break strengths must be per ASTM E-8 procedures. Safety factor of 1.5 may
be used when pre-stretched cable is used with end connections designed to meet the cable break strength. Otherwise safety factor 3.76 must be used. Cables shall be sized for a force as listed in section 1.3. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation. Restraint shall be type LRC.

2.4 **ROOFTOP UNIT CURBS AND ISOLATION SYSTEMS**

A. Specification X: Non isolated seismically rated rooftop curb system that is flashed into roofing membrane. Air and watertight curb shall have a neoprene sponge seal at the top and be rigid enough provide continuous perimeter support for rooftop unit. Curb must provide means to positively anchor to concrete deck, or bolt or weld directly to structural steel to withstand seismic loading. Curb shall provide a means by which contractor supplied insulation may be installed for thermal insulation and acoustic attenuation. Curbs shall accommodate roof pitch shown on drawings. Curb shall use minimum 16 gage galvanized steel and shall be designed with cross bracing required to withstand the greater of seismic forces or wind loading per local building code.
Design must be certified by registered professional engineer in the employ of the manufacturer. Seismic curbs shall be Amber/Booth Type RTC. Steel shall be primed with metal etching primer.

B. Specification Z: Seismically rated rooftop isolation curb system that is flashed into roofing membrane. Standard unit curb will not be used. Air and watertight upper curb shall have a neoprene sponge seal at the top and be rigid enough provide continuous perimeter support for rooftop unit. The upper curb shall be supported by type C isolators welded or bolted to continuous structural support which is positively anchored to concrete deck or bolted or welded to the structure to withstand seismic loading. An EPDM nylon reinforced air tight weatherproof seal shall consolidate the upper and lower curbs. Weatherproof access doors shall be provided at each isolator to allow isolator adjustment. Isolation curb shall provide a means by which contractor supplied insulation may be installed for thermal insulation and acoustic attenuation. Curbs shall accommodate roof pitch shown on drawings. Isolation curb shall use minimum 16 gage galvanized steel and shall be designed with cross bracing required to withstand the greater of seismic forces or wind loading per local building code. Design must be certified by registered professional engineer in the employ of the manufacturer. Isolation curbs shall be Amber/Booth Type RTIC. Steel shall be primed with metal etching primer. Steel exposed to view or outdoors shall be primed and painted to match unit color.

PART 3 – EXECUTION

3.1 Isolator and seismic restraints shall be installed as recommended by the manufacturer. Isolate all mechanical equipment 3/4 hp and over per the isolation schedule and these specifications.

3.2 **DUCT ISOLATION:**

Isolate all duct work with a static pressure 2” W.C. and over in equipment rooms and to minimum of 50 feet from the fan or air handler. Use specification type E hangers or type SB (SX) floor mounts.

3.3 **INSTALLATION**

A. Comply with manufacturer’s instructions for the installation and load application of vibration isolation materials and products. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points. Remove space blocks and similar devices (if any) intended for temporary support during installation or shipping.

B. Locate isolation hangers as near the overhead support structure as possible. Adjust leveling devices as required to distribute loading uniformly on isolators. Shim units as required where leveling devices cannot be used to distribute loading properly. Install isolated inertia base frames and steel bases on isolator units as indicated so that a minimum of 1inch clearance below base will result when supported equipment has been installed and loaded for operation.

C. Seismic Rated roof curbs shall be installed directly to building structural steel or concrete roof deck. Installation on top of steel deck or roofing material is not acceptable. Shimming of seismic rated curbs is not allowed. Housekeeping Pads shall be constructed and installed per ASHRAE's "A Practical Guide to Seismic Restraint". They shall be a minimum of .5" thicker than the maximum embedment required of any anchor but not less than 6". They shall be sized to provide minimum edge distances for all installed anchors. They must be anchored to the floor structure in an approved manner.

3.4 APPLICATION OF SEISMIC RESTRAINTS

A. All floor mounted isolated equipment shall be protected with type SB or type C unitized isolator and restraint or with separate type SL restraints (minimum of 4. Floor mounted non-isolated equipment shall be protected by properly sized anchor bolts with elastomeric grommets provided by the isolation manufacturer All suspended equipment and vessels shall be protected with specification SC restraints. Cables shall be installed to prevent excessive seismic motion and so arranged that they do not engage during normal operation.

B. All piping shall be protected in all planes by SC restraints, designed to accommodate thermal movement as well as restrain seismic motion. (spring-loaded control rods should be used on flexible connectors in system). Tanks and vessels connected in line to piping shall be restrained independently. Locations shall be as determined by the isolator/seismic restraint supplier.

C. Where riser pipes pass through cored holes, core diameters to be a maximum of 2" larger than pipe O.D. including insulation. Cored holes must be packed with resilient material or fire stop as provided by other sections of this specification or local codes. No additional horizontal seismic bracing is required. Restrained isolators type C or SB shall support risers and provide longitudinal restraint at floors where thermal expansion is minimal and will not bind isolator restraints. For risers in pipe shafts, specification SC cable restraints shall be installed at each level in a manner that does not interfere with thermal movement.

3.5 DUCT WORK

Duct work shall be protected in all planes by SC restraints. Locations shall be determined by the isolator supplier.

3.6 EQUIPMENT ISOLATION AND SEISMIC SCHEDULE

EQUIPMENT TAG	COMPONENT ISOLATION Ip	SPEC. REST,	SEISMIC SPEC.,	ISOLATION DEFL.
Air Handling Units	1.0	Internal By Manuf.	Note 1	2"
Air Handling Units (Flr)	1.0	Spec SB/Spec K	Spec SB	1"
Fan VAV Term.	1.0	Spec D	Spec SC	.5"
Inline Fans	1.0	Spec D	Spec SC	1"

Pkgd Heat Pump Units (On Roof)	1.0	Spec X/Spec Z	Note 4	0.15"
Unit Heaters (Susp)	1.0	None	Spec SC	N/A
Cabinet Heaters (Susp)	1.0	Spec D	Spec SC	.5"
Kitchen Hoods	1.0	None	Spec SC	N/A

Notes

1. Anchor bolts for non-isolated and internally isolated equipment shall be sized by the seismic restraint supplier. If required, Spec. SL snubbers or Spec. SC cable kits shall be provided.
2. Roof curbs provided by others must be certified by a professional engineer for the required seismic loads.
3. All Life Safety equipment, gas fired equipment, and all equipment in Seismic Use Group III buildings shall have Ip = 1.5.
4. Provide vibration isolation rails for all units larger than 10 tons

***See architectural and structural for applicable projects seismic factors.**

END OF SECTION 23 05 48

SECTION 23 05 53 IDENTIFICATION AND LABELING

PART 1 - GENERAL

1.1 1.1 The provisions of the GENERAL CONDITIONS OF THE CONTRACT, the SUPPLEMENTARY CONDITIONS, and Section 23 00 00 Mechanical General of the Specifications, apply to the work under this Section to the same extent as if fully included herein.

1.2 All equipment and materials for this project shall be purchased from and furnished to the contractor by the manufacturer's local representative for Mechanical Design, Inc. No submittals for equipment or materials will be received where the local representative has not originated the submittal data for this project. All non-compliant submittals will be promptly rejected.

1.3 The record drawings shall include mechanical identification on all serviceable components of piping and duct work systems and shall reference applicable valve tag charts and/or riser diagrams. This section contains the requirements relating to the materials and methods used to identify items described in Division 23.

1.4 IDENTIFICATION OF UNDERGROUND PIPING

A. WARNING TAPE

All underground piping and utilities shall have metalized warning tape installed above the pipe or line that identifies the specific system buried below. Tape shall consist of a minimum 3.5 mil solid foil core encased in a protective plastic jacket (total thickness 5.5. mils) and be 6" wide with black lettering imprinted on a color-coded background that conforms to APWA color code specifications. Tape shall be installed from 18" to 30" above the pipe and in no case less than 6" below grade.

B. TRACER WIRE

All non-metallic pipe installed underground shall have a tracer wire installed along the length of the pipe. Tracer wire shall be 14 gauge minimum, copper single-conductor wire with insulation and shall be continuous along the pipeline passing through the inside of each valve box.

PART 2 – PRODUCTS

2.1 PAINTED IDENTIFICATION MATERIALS

A. STENCILS

Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications but not less than 11/4" high letters for ductwork and not less than 3/4" high letters for access door signs and similar operational instructions.

B. STENCIL PAIN

Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

2.2 **VALVE TAGS**

A. BRASS VALVE TAGS

B. Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers ½" high and with 5/32" hole for fastener. Provide 1-1/2" diameter tags except as otherwise indicated.

C. PLASTIC LAMINATE VALVE TAGS

Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" square black tags with white lettering, except as otherwise indicated.

2.3 **ENGRAVED PLASTIC-LAMINATE SIGNS**

A. GENERAL

Provide engraving stock melamine plastic laminate, in the sizes and thickness indicated, engraved with engraver's standard letter style of the sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. THICKNESS

1/16" for units up to 20 square inches or 8" length; 1/8" for larger units.

C. FASTENERS

Self-tapping stainless-steel screws.

2.4 **WRAP-AROUND PLASTIC IDENTIFICATION**

All plumbing/mechanical piping identification shall adhere to ANSI A13.1 – 1981. Interior piping, all locations, shall utilize Seton "Setmark" or equal pipe markers. Exterior piping in exposed locations such as manholes/tunnels, at pad mounted chiller, etc., shall utilize Seton "Ultra-mark" or equal pipe markers. All pipe markers shall be snap around whenever possible. Markers shall be located at each wall, floor or ceiling penetration, whether exterior or interior, and every 20 ft. thereafter. Markers shall be fully legible from floor level showing medium contained in pipe, and directional arrows.

Piping shall be identified as follows:
HEATING WATER SUPPLY, HEATING WATER RETURN, CHILLED WATER SUPPLY, CHILLED WATER RETURN, CONDENSATE, CHEMICAL FEED & others by approval by submittals.

PART 3 – EXECUTION

3.1 **INSTALLATION REQUIREMENTS**

A. COORDINATION

Coordinate new labeling with existing labeling through Project Manager. Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, identification shall be installed after completion of covering and painting. Identification is to be installed prior to installation of acoustical ceilings and similar removable concealment.

B. DUCTWORK IDENTIFICATION

1. Provide for identification of air supply, return, exhaust, intake, and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow, in black and white.

2. Locations: Ductwork shall be identified every 20’ in spaces with removable ceilings and at each access door in spaces with hard ceilings. Exposed ductwork shall be identified every 20’ in mechanical rooms. As described above, ductwork shall be labeled on both sides of floor and wall penetrations.

3. Access Doors: Provide engraved plastic-laminate signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate and procedural information.

C. PIPING SYSTEM IDENTIFICATION

1. Provide for pipe markers as follows:
Wrap around plastic identification with application system as indicated under Part 2 Products in this Section. Include arrows to show normal direction of flow. For hot non-insulated pipes, install a segment of pipe insulation with appropriate piping identification.

2. Locate identification as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.

   a. Near each valve and control device.
   b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
   c. At locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
   d. At access doors, manholes and similar access points which permit view of concealed piping.
   e. At major equipment items and other points of origination and termination.
   f. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
   g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
   h. Identify non potable piping and outlets.

D. VALVE IDENTIFICATION

Provide for valve tags on every valve and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, HVAC terminal devices and similar rough in

connections of end-use fixtures and units. List each tagged valve in a valve schedule for each piping system.

E. MECHANICAL EQUIPMENT IDENTIFICATION

Provide for engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device. Provide signs for the following general categories of equipment and operational devices:

1. Main control and operating valves, including safety devices
2. Meters, gauges, thermometers and similar units.
3. Fuel-burning units including boilers, furnaces, and heaters.
4. Pumps, compressors, chillers, condensers and similar motor-driven units.
5. Heat exchangers, coils, evaporators, cooling towers, heat recovery units and similar equipment.
6. Fans, blowers, primary balancing dampers and VAV boxes.
7. HVAC central-station and zone-type units.
8. Tanks and pressure vessels.
9. Air conditioning indoor and outdoor units.
10. AFD's and transmitters and Control Boxes.
11. Other items as specified by Project Manager.

END OF SECTION 23 05 53

SECTION 23 05 93 TESTING ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 The provisions of the GENERAL CONDITIONS OF THE CONTRACT, the SUPPLEMENTARY CONDITIONS, and Section 23 00 00 Mechanical General of the Specifications, apply to the work under this Section to the same extent as if fully included herein.

1.2 All equipment and materials for this project shall be purchased from and furnished to the contractor by the manufacturer's local representative for Mechanical Design, Inc. No submittals for equipment or materials will be received where the local representative has not originated the submittal data for this project. All non-compliant submittals will be promptly rejected.

1.3 Work under this section includes the testing, adjusting and balancing air and water systems in all heating, ventilating and air conditioning systems. The results of all tests, adjustments and balancing shall be submitted to the Architect for approval.

1.4 Other sections of the specification are a part of this section. Refer to all other sections for a complete description of the work.

1.5 COMMISSIONING (HVAC)

A. The contractor shall provide all coordination, submittal data and shop drawing information to comply with the commissioning requirements as specified. Commissioning is the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent. Commissioning shall be performed in accordance with the Building Commissioning Association's standards or ASHRAE. The commissioning process shall begin no later than the bid phase and continue through the two year warranty period.

B. The testing and balancing contractor in conjunction with the mechanical contractor and controls contractor shall submit a statement to the Engineer that check test and start-up has been successfully completed and that all equipment, systems and controls are complete and ready for functional performance testing.

C. The testing and balancing contractor, controls contractor and mechanical contractor shall work closely for verification of the HVAC system and all components throughout project construction. A report issued by the T&B contractor shall test the dynamic function and operation of equipment and systems executed by the Contractor. Systems are tested shall be various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, life safety conditions, power failure, etc. Systems are run through all specified sequences of operation. Components are verified to be responding in accordance with Contract Documents. Functional Performance Tests are executed after start-ups and Prefunctional Checklists are complete.

1.6 Testing and balancing of the HVAC system is defined as the optimization of the installed system. The equipment schedule is used for equipment selection only. Industry standards of +-10% are considered to be benchmarks and will not be used as an absolute requirement for final acceptance of the project. Approval of the final report will be the sole responsibility of the design engineer.

1.7 TESTING AND BALANCING AGENCY

A. All work shall be performed by an independent Test and Balance Agency. Testing, adjusting and balancing work shall be the firm's sole source of income. All work shall be under the direct supervision of a project manager who is qualified for testing and balancing the hydronic and air performance of heating, air conditioning, and ventilating systems.

B. The testing and balancing contractor will test and balance the systems according to NEBB standards. The T&B contractor will provide the mechanical contractor with a written list of all project deficiencies and copy the engineer via fax. The T&B contractor will work with the engineer and contractor to insure that any and all deficiencies are adequately addressed prior to submission of the final report. The engineer will be provided with a T&B summary prior to submission of the final report. The T&B Contractor shall notify the engineer and contractor immediately of any deficiencies which impede balancing and any inability to to meet the specified requirements.

C. The design engineer may request verification of data at any time during or after the T&B process. The test, balancing and adjusting shall be performed as many times as required to prove project requirements have been met. If requested by the Engineer, tests shall be performed in his presence

D. The Testing and Balancing firm will be certified by NEBB and have a minimum of ten years experience in testing and balancing. Acceptable firms to perform testing and balancing on this project are:

1.8 RESPONSIBILITY OF OTHERS

A. Mechanical Contractor- The mechanical contractor is responsible for installing the systems per the plans and specification. The mechanical contractor is also responsible coordinating work between the T&B and Control contractor. All system deficiencies will be corrected/optimized prior to the submission of the T&B report. The mechanical contractor will supply the test and balance contractor with accurate drawings, submittals, and support required to optimize the system(s).

B. Control Contractor- The control contractor shall work closely with the T&B contractor during testing and balancing to insure proper operation of the control system. The control contractor will functionally check the controls prior to the T&B process. The T&B process will not begin until the control system has been checked and approved by the control contractor. The control contractor will furnish any software required to test and balance the system(s).

1.9 INSTRUMENTS

Instruments used shall be of high quality and as recommended by AABC or NEBB for the application. Instruments shall be properly calibrated and certified within the last six months.

1.10 ACCURACY

The balancing firm shall warrant, solely that the system will be set to the values as established by the drawings and specifications and also adjust to minimize drafts in all areas.

SECTION 23 05 93

1.11 CHANGES

1.12 Any changes that are required for the final balancing results as determined by the balancing firm shall be provided under this section of the specifications. Such changes shall include, but not limited to, changing of pulleys, belts, dampers or adding dampers or access panels.

PART 2 – PRODUCTS

2.1 SUBMITTALS:

A. Prior to acceptance of the systems by the Owner, submit to the Engineer for his review, a written testing, adjusting and balancing report, in triplicate, contained in a hard-backed three ring notebook.

B. All reports, forms and data sheets shall generally be the standards of AABC or NEBB.

PART 3 – EXECUTION

3.1 BALANCING PROCEDURE:

A. Before starting air balance, check the following items:

- Air filters to assure cleanliness and position
- All fans for proper belt tension, alignment and rotation
- Fan and motor lubrication

B. Measure supply air volumes by means of the duct traverse method, taking a minimum of 16 readings. Seal duct access holes with snap-in plugs. The use of duct tape to seal access holes will not be allowed.

C. Adjust balancing dampers for required branch duct air quantities. Dampers shall be permanently marked after air balance is complete.

D. The total air delivery in any particular fan system shall be obtained by adjustment of the particular fan speed or air valve set point. The drive motor of each fan shall not be loaded over the corrected full load amperage rating of the motor involved.

3.2 ADJUSTING AND BALANCING

Adjust, balance, record and submit as previously specified, for each of the following:

Grilles and Diffusers:

Fan Mark	Room if Applicable	Design CFM	Measured CFM

Packaged Rooftop Units:

Grilles and Diffusers as specified in (1) above
Supply Air Dry Bulb Temperature (Cooling, Heating, and Dehumidification) Total CFM
Return Air CFM
Outside Air CFM
Total Static Pressure
External Static Pressure
Nameplate Data (Supply Fan, Condenser Fan, Compressors)
Actual Motor Amperage and Voltage
Fan RPM

END OF SECTION 23 05 93

SECTION 23 07 00 MECHANICAL, INSULATION

PART 1 - GENERAL

1.1 The provisions of the GENERAL CONDITIONS OF THE CONTRACT, the SUPPLEMENTARY CONDITIONS, and Section 23 00 00 Mechanical General of the Specifications, apply to the work under this Section to the same extent as if fully included herein.

1.2 All equipment and materials for this project shall be purchased from and furnished to the contractor by the manufacturer's local representative for Mechanical Design, Inc. No submittals for equipment or materials will be received where the local representative has not originated the submittal data for this project. All non compliant submittals will be promptly rejected.

1.3 INSULATION

All insulation material shall have a fire hazard classification not to exceed flame spread of 25 and smoke developed rating of 50, as listed by Underwriters Laboratories and acceptable under NFPA standards. This is to apply to the complete system and to the composite insulation with jacket or facings, vapor barrier, tapes, mastic and fittings.

1.4 INSULATION FIRM

All insulation work shall be performed by a franchised insulation firm. All insulation shall be installed in a workmanlike manner by qualified workers in the regular employ of the insulation firm.

1.5 SUBMITTALS

Provide shop drawings of all materials. Indicate "installed" insulation R-values and insulation thicknesses provided. Shop drawings shall include an outline on the insulation firm's company letter head stipulating what materials will be used with each system.

PART 2 - PRODUCT

2.1 DUCT INSULATION/LINER

A. All ducts shall be insulated with flexible glass fiber blanket duct wrap except where noted to be double wall duct or otherwise specified.

PART 1 - Ducts located within the building thermal envelope: Insulation for sheet metal ducts shall be 2.33" thick Johns Manville Microlite XG commercial grade formaldehyde-free fiber glass duct wrap or equal. Insulation shall be .75lb. density (installed R-6.5 min) with FSK vapor barrier. Insulation shall meet the UL 25/50 smoke develop/flame spread requirements.

PART 2 - Ducts located outside the building thermal envelope: Insulation for sheet metal ducts shall be thick Johns Manville Microlite XG commercial grade formaldehyde-free fiber glass duct wrap or equal. Insulation shall be .75lb. density (installed R-8.3 min) with
EMERALD HIGH SCHOOL ADDITIONS & RENOVATIONS SECTION 23 07 00
GREENWOOD SCHOOL DISTRICT 50 MECHANICAL; INSULATION

FSK vapor barrier. Insulation shall meet the UL 25/50 smoke develop/flame spread requirements. Provide an aluminum clad jacketing over rigid insulation. Slope horizontal insulation to prevent ponding.

B. Acoustical duct liner shall be 1" thick Armacell Coilflex (R-4 min with EPA Registered Antimicrobial) closed cell liner.

C. Ductwork shall be constructed as job progresses and not in advance to prevent damage to ductwork on site. Ductwork shall not be prefabricated more than 1 week in advance of installation.

2.2 PIPE INSULATION

A. Flexible pipe insulation shall be Armaflex, or equal. Flexible pipe insulation and associated products shall meet flame and smoke rating listed in the "General" paragraph of this section of the specifications. Flexible pipe insulation adhesive shall be an air-drying contact adhesive for temperatures up to 220 degrees F, equal to Armaflex 520. Adhesive shall meet Military Specification MIL-A-24179A and Amend-2 as Type II, Class 1.

B. Fiberglass pipe insulation shall be Owens-Corning one-piece heavy density fiberglass pipe insulation with the ASJ/SSL-II jacket.

C. See Section 23 00 00 Mechanical, General for pipe markers.

2.3 **FIREPROOFING DUCT WRAP**

A. Provide UL - classified, non combustible duct wrap to provide passive fire protection of air and grease ducts. Wrap shall have zero clearance to combustible protection.

B. Ductwrap for kitchen exhaust duct shall be UL labeled 1-1/2" thick Firetemp Wrap foiled one side fire proofing insulation as manufactured by Johns Manville.

C. The wrap shall be 1-1/2" - UL classified, non-combustible product. The wrap shall be a fire-rated blanket, high temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 1 to 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.

PART 3 – EXECUTION

3.1 DUCT INSULATION

A. All insulation work shall be performed by a franchised insulation firm. All insulation shall be installed in a workmanlike manner by qualified workers in the regular employ of the insulation firm.

B. All sheet metal supply, return, fittings, exhaust and outside air ducts shall be insulated with 2" ductwrap except where specified otherwise herein. Adhere insulation on ducts to metal with 4" strips of insulation bonding adhesive at 8" centers. Secure insulation on ducts over 24" wide with weld pins and clip washers spaced not more than l5" o.c., to bottom of duct. Staple insulation at all seams with outward clinch staples and vapor sealed with a 3" piece of Glasfab

coated completely with a flame retardant LEED approved mastic. This application also applies at connections to pre-insulated flexible ductwork. Duct tape and pressure sensitive foil tapes will

not be allowed. Use of tapes will require complete removal and repair of duct insulation prior to resealing of joints and seams.

C. Provide duct liner in return and transfer ducts.

3.2 PIPE INSULATION

A. Condensate drain pipes shall be insulated with 1/2” flexible pipe insulation. Slip insulation on prior to connection and seal all butt joints with adhesive. On tees and ells greater than 45 degrees, insulation shall be mitered and sealed with adhesive. Entire installation shall be in strict accordance with the manufacturer's recommended installation instructions.

B. Refrigerant and condensate drain piping insulation shall be 1/2" thick Armaflex insulation not to exceed flame spread of 25 and smoke developed rating of 50, as listed by Underwriters Laboratories.

3.3 REFRIGERANT PIPE INSULATION

A. All refrigerant suction and condensate drain lines shall be insulated completely. Seal all joints and seams with adhesive as specified.

B. Provide pipe insulation on liquid line for ductless split system heat pumps.

C. Where insulation is exposed to view outdoors and indoors, cover insulation with an aluminum jacket. It shall be applied with a 2" circumferential and a 1-1/2" longitudinal lap secured with 3/8" bands 8" on center.

END OF SECTION 23 07 00

SECTION 23 31 13 MECHANICAL DUCTWORK

PART 1 - GENERAL

1.1 The provisions of the GENERAL CONDITIONS OF THE CONTRACT, the SUPPLEMENTARY CONDITIONS, and Section 23 00 00 Mechanical General of the Specifications, apply to the work under this Section to the same extent as if fully included herein.

1.2 All equipment and materials for this project shall be purchased from and furnished to the contractor by the manufacturer's local representative for Mechanical Design, Inc. No submittals for equipment or materials will be received where the local representative has not originated the submittal data for this project. All non-compliant submittals will be promptly rejected.

1.3 All ductwork shall meet job conditions and after coordinating with all trades. Follow duct dimensions indicated on drawings as closely as possible. Provide offsets, vary shape or alter run if required to meet structural or other interferences. Where shape of duct is varied, alter dimensions to provide equal static pressure drop per unit length.

1.4 Obtain copies of applicable "Sheet Metal and Air Conditioning Contractors National Association, Inc." (SMACNA) Manuals, latest edition, and keep one copy of each on job site.

1.5 Ductwork shall be air tight, smooth on inside and neatly finished on outside. Details of support, construction and materials not specified herein to be in accordance with recommendations of SMACNA.

1.6 Construct ductwork as job progresses and not in advance. Ductwork shall not be prefabricated more than 1 week in advance of installation.

1.7 No ductwork shall be fabricated or installed until all space requirements have been thoroughly coordinated with all other trades.

1.8 **COORDINATION SHOP DRAWINGS**

A. The General/Electrical/Plumbing contractor shall coordinate and assist the Mechanical contractor in preparation of detailed coordination shop drawings for all systems. Drawings shall be prepared to carefully coordinate with architectural, plumbing, sprinkler, electrical and structural drawings regarding elevation, access, serviceability and replacement of systems. Space priorities shall be coordinated and established with each trade prior to beginning work to prevent field conflicts. No extra payments for changes or modifications will be allowed any contractor where work has begun without fully coordinated shop drawings. A completed set of coordinated shop drawings shall be submitted to the Design Team for review prior to beginning any work or ordering of any associated equipment, piping, wiring, steel, fixtures, conduits, etc.

B. Each trade contractor shall coordinate its construction operations and space requirements with those of other contractors and entities to ensure efficient and orderly installation of each trade. These parameters shall be incorporated into the shop drawings developed to identify and resolve any potential conflicts prior to project construction.

C. Coordination meetings shall be held with the general contractor and MEP contractors at the beginning of the project and prior to start of construction in any area, to development the coordination drawings and resolve potential installation conflicts. Coordination meetings for the purpose of producing coordinated shop drawings shall be scheduled by area(s) and held during drawing development and shall continue through project completion. Coordination shall include:

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the work depends on installation of other components, before, during or after its own installation.

2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required for maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for any installation phase including known future work.

4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical, electrical and plumbing.

5. Where conflicts arise during the coordination or construction phase, the construction team shall identify conflicts and present cost effective solutions to accompany RFI's to the design team for review and issuance of directive resolution measures.

D. Shop drawings shall show the routing of all water piping, supply, return, exhaust and fresh air ductwork closely following the contract drawings and specifications. Drawings shall be detailed to miss any structural elements and work of all other trades and shall include the following as a minimum:

1. HVAC
   All necessary heating, ventilating, air-conditioning and specialty equipment, including air handlers, pumps, piping, air distribution ducts for supply, return, and ventilation and exhaust ducts, including control system, registers, diffusers, grills necessary to produce accurate plans, elevations, building/wall sections and schedules. All piping larger than 1.5" diameter shall be modeled.

2. PLUMBING
   All necessary plumbing piping and fixture layouts, floor and area drains, and related equipment, necessary to produce accurate plans, elevations, building/wall sections, riser diagrams, and schedules. All piping larger than 1.5" diameter shall be modeled.

3. ELECTRICAL
   All necessary interior electrical components (i.e., lighting, receptacles, special and general purpose power receptacles, lighting fixtures, control systems), necessary to produce accurate plans, details and schedules. Cable tray routing shall be modeled without detail of cable contents.

E. Ductwork drawings shall show size, length of each piece, top and bottom elevations and placement of registers and grilles. Fittings shall also show throat length or radius, amount of rise or fall and amount of offset. **All riser ducts shall be shown where indicated on drawings. Shaft ducts shall be detailed and fully dimensioned**.

F. Drawings shall detail exact placement of all HVAC equipment and shall define access and service area required for each piece of equipment. Pad drawings of air handling units if required shall also be included and fully detailed.

1.9 PROTECTION OF DUCT SYSTEMS

A. Construct ductwork as job progresses and not in advance to prevent damage to ductwork on site. Ductwork shall not be prefabricated more than 1 week in advance of installation.

B. Ductwork shall be stored indoors and protected from damage prior to installation. Weathered or damaged ductwork will be rejected and replaced at the contractor's expense.

C. All supply, return and exhaust ductwork shipped to the job site shall have the ends sealed with plastic to prevent accumulation of dirt and debris. Plastic shall be removed only upon installation of duct. All remaining openings in ductwork shall be fully protected with plastic sealed to duct until connected to equipment, grilles, ductwork, etc. There are no exceptions. Ductwork not protected and installed in this manner will be rejected and replaced at the contractor's expense.

D. The Mechanical contractor shall provide temporary filters to maintain a clean duct system during temporary service. Filters shall cover return grilles and any other openings in ductwork with a minimum MERV-8 filter to protect the duct system from accumulation of organic material. All HVAC equipment utilized to maintain building temperature during construction shall also contain a minimum of MERV-8 filtration.

1.10 FIRE STOPPING AND SMOKE SEALS

A. All fire-stopping on this project shall be installed by a single source contractor. All penetrations through fire resistive construction shall be sealed in accordance with Section 07-8400. Products used for fire stopping shall be by the same manufacturer throughout the building for all trades.

B. The Mechanical Contractor shall be responsible for coordinating fire stopping and joint seals as required for the work in this section. Coordinate fire stopping work with the General Contractor and Construction Manager for all ire-stopping work.

PART 2 - PRODUCT:

2.1 SHEET METAL DUCTWORK

Sheet metal ductwork shall be in accordance with SMACNA Manual "Low Velocity Construction Standards," latest edition. All sheet metal duct shall be a minimum of 26 gauge or higher as required by SMACNA, these specifications, or as noted on the drawings.

2.2 FLEXIBLE DUCTWORK

Fiberglass flexible round duct shall be a minimum of 1" thick Owens-Corning or equal by Genflex. The product shall bear a U.L. 181 Class 1 Air Duct label.

2.3 EXPOSED DUCTWORK

A. Ductwork exposed to view in finished areas shall be constructed of galvanized sheet metal free from visual imperfections including pitting, seam marks roller marks, stains, discolorations and other imperfections including those which would impair painting. Exposed duct shall be primed by the Mechanical Contractor and ready for final painting by the General Contractor.

B. Round duct shall be equivalent to Uni-Rib duct with Uni-Weld fittings as manufactured by United Sheet Metal, Simco, Eastern Sheet Metal, Hamlin/Turn Key, MTI, or approved equal. The company shall have manufactured spiral duct for a minimum of 10 years.

C. All ducts and fittings shall be pre-insulated double wall ducts. The outer wall shall be of spiral lock seam construction with or without intermediate standing rib to provide rigidity. The performance shall be the same for spiral duct without a rib. The duct and fittings shall be fabricated from paint gripping sheet metal of a thickness not less than 26 gauge. The inner wall shall be 28 gauge galvanized solid steel inner wall to completely encapsulate the interior liner insulation. The duct shall be lined with 1" insulation.

D. The duct and fittings shall be assembled by means of a slip joints sealed with high velocity sealant. Care shall be taken to prevent sealant on the exterior of duct.

E. Slot diffusers or take-offs shall be factory mounted by the duct manufacturer. Coordinate with diffuser manufacturer size and mounting instructions.

F. Ductwork shall be stored indoors and protected from damage prior to installation. Weathered or damaged ductwork will be rejected and replaced at the contractor's expense.

2.4 LOW PRESSURE DUCTWORK

A. Sheet metal ductwork shall be in accordance with SMACNA Manual "Low Velocity Construction Standards," latest edition.

B. Fiberglass flexible round duct shall be a minimum of 1" thick Owens-Corning or equal by Genflex. The product shall bear a U.L. 181 Class 1 Air Duct label.

2.5 Dampers

Refer to air distribution specification for control, balance, fire, and fire/smoke damper requirements.

2.6 DUCT ACCESS DOORS

Access door shall be SMACNA Standard and shall be constructed of 22 gage galvanized steel. The doors shall be hinged double skin insulated door with thumb latch and foam gasketed seal. The doors shall be sized and located so devices may be conveniently inspected or removed, tested and reset. Door size shall not be less than 12" x12" unless required by duct size. Access doors shall be Ruskin model ADH or approved equal.

2.7 ACCESS PANELS

Provide heavy duty 16 gage type 304 stainless steel finish, concealed hinge, access panel with flush mounted keyed locking device as manufactured by Karp, Elmdoor or Bilco. Provide doors to permit access and/or removal of dampers, operators, equipment, etc. Minimum sized shall be 12"x12". Coordinate location of panels with all trades prior to installation. Panels shall be suitable for installation flush with finished ceiling and wall surfaces. See architectural drawings for type required. It shall be the responsibility of the mechanical contractor to identify locations for all access panels required for equipment and provide doors for installation by the general contractor.

PART 3 - EXECUTION:

3.1 DUCTWORK

A. All supply air ductwork from air handling units shall be low pressure duct. Installation shall be in strict accordance with SMACNA.

B. All return, exhaust and outside air ducts shall be galvanized sheet metal ductwork as specified above except where noted other wise.

C. Provide welded aluminum duct for all ductwork routed on the exterior of the building.

D. Provide welded stainless steel duct for kitchen hood and dishwasher exhaust systems. Refer to drawings for notes, construction requirements, and light testing.

E. All turns greater than 45 degrees shall be made with turning vanes. Turning vanes shall be single vane type installed on runners.

F. Support horizontal ducts with angle support and threaded rod spaced not more than eight (8) feet apart, at every transverse joint and at changes in direction.

G. Duct sizes indicated on plans are interior dimensions. Increase metal duct sizes as required for acoustical or interior insulation.

H. Construct, brace, and support ducts in manner that they will not sag nor vibrate when fans are operating at minimum speed and capacity.

I. Provide 1" diameter test slots with cover for insertion of thermostat or test instruments at all locations required to perform operations required under Section 23 05 93.

J. Provide duct access doors to afford easy access to entering air side of items requiring maintenance or inspection (such as fire dampers, etc.). Doors to be of ample size for service required.

K. Protect all fan and duct openings from dirt and rubbish during construction. Clean system to be delivered to owner.

L. All interior portions of ductwork visible through grilles or diffusers shall be painted with flat black paint.

M. Each section of flexible round duct shall have locking worm clamps designed to connect to duct take-off fittings and terminal units. **Maximum run of flexible duct shall be 6 feet**.

N. Take-offs from low pressure trunks to diffusers shall be a factory-manufactured spin-in type fitting with air-scoop and manual balancing damper. Install take-off per the manufacturer's recommendations.

O. Provide canvas type flexible duct connectors at air handling units at all supply, return and outside air duct connections if not factory provided. Provide flexible duct connectors at inlet and discharge of inline fans. Flexible duct connectors shall conform to NFPA 90A.

3.2 FLEXIBLE DUCTWORK

Each section of flexible round duct shall have stainless steel locking worm clamps designed to connect to duct take-off fittings and terminal units. **Maximum run of flexible duct shall be 6 feet**.

3.3 RUNOUT TAKE-OFFS

Take-offs from low pressure trunks to diffusers or modulating damper units shall be a factorymanufactured spin-in type fitting with air-scoop and manual balancing damper. Install take-off per the manufacturer's recommendations.

3.4 FIRE DAMPERS

A. Fire dampers shall be installed in openings utilizing steel sleeves, angles and other materials and practices required to provide an installation equivalent to that utilized by the manufacturer when dampers were tested at U.L. Installation shall be in accordance with damper manufacturer's written installation instructions.

B. Fire damper shall be sized so that the free area is not less than the connected duct free air space.
C. Install fire dampers in strict with Underwriters Laboratory tested installations, manufacturer's written installation instructions and NFPA requirements. See detail on drawings.

D. Combination fire/smoke dampers shall be installed complete and ready for operation including power wiring. Connection to the fire alarm system when present shall be by Division 26.

3.5 SEISMIC RESTRAINT OF DUCTWORK:

A. Seismically restrain all ductwork with cable restraints as listed below:

1. Restrain rectangular ducts with cross sectional areas of 6 square feet and larger.

2. Restrain round ducts with diameters of 28" and larger.

3. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.

B. Seismic cable restraints shall consist of steel cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Seismic loads shall be based on a peak acceleration coefficient of 0.15.

C. No restraints are required if the duct is suspended by hangers 12" or less in length, as measured from the top of the duct to the bottom of the support where the hanger is attached. Hangers must be positively attached to the duct within 2" of the top of the duct with a minimum of two #10 sheet metal screws.

D. Transverse restraints shall occur at 30' intervals or at both ends if the duct run is less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.

E. Longitudinal restraints shall occur at 60' intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as longitudinal restraints for a duct section connected perpendicular to it if the restraints are installed within four feet of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.

F. Walls, including gypsum board non-bearing partitions, which have ducts running through them may replace a typical transverse brace. Provide solid blocking around duct penetrations at stud wall construction.

G. Unbraced ducts shall be installed with 6" minimum clearance to vertical ceiling hanger wires.

END OF SECTION 23 31 13

SECTION 23 34 00 MECHANICAL, FANS AND AIR DISTRIBUTION

PART 1 - GENERAL

1.1 The provisions of the GENERAL CONDITIONS OF THE CONTRACT, the SUPPLEMENTARY CONDITIONS, and Section 23 00 00 Mechanical General of the Specifications, apply to the work under this Section to the same extent as if fully included herein.

1.2 All equipment and materials for this project shall be purchased from and furnished to the contractor by the manufacturer's local representative for Mechanical Design, Inc. No submittals for equipment or materials will be received where the local representative has not originated the submittal data for this project. All non-compliant submittals will be promptly rejected.

1.3 **FANS**

A. Each fan shall bear the AMCA seal for rated sound and air.

B. Noise level indicated is maximum level in zones for fans and curb combination at 5'-0" distance in accordance with AMCA Standards 210 and 300.

1.4 GRILLES AND DIFFUSERS

A. Sizes indicated on drawings are general and are based on the first listed manufacturer. Final selection to be used on equipment to be installed with sizing in accordance with manufacturer's recommendations and above limitations. Coordinate ductwork sizes with final diffuser selections.

B. Ceiling grilles and diffusers shall be of type frame and design to best match the ceiling construction in which installed. Use type shown on drawings as a guide. Verify ceiling type from architectural drawings.

1.5 FIRE DAMPERS

Fire dampers shall be constructed and tested in accordance with U.L Safety Standard 555. Fire dampers shall bear the U.L. label.

1.6 MOTORS

All fan motors shall be premium efficiency type inverter duty rated

PART 2 – PRODUCTS

2.1 FIRE DAMPERS

A. Fire dampers shall be provided with 212°F fusible link. Fire dampers shall be equipped for vertical installation in walls or horizontal installation in floors. Fire dampers shall possess a 11/2 hour U.L. label for installation in fire partitions rated at 2 hours or less or 3 hour U.L. label for installation in fire partitions rated at 3 hours or more, see architectural drawings.

GREENWOOD SCHOOL

B. Fire dampers rated for 1-1/2 hour shall be Ruskin model DIBD2, type "B." Fire dampers rated for 3 hour shall be Ruskin model DIBD2, type "B." Fire dampers in walls behind wall mounted grilles or diffusers shall be type "A". All fire dampers shall be dynamic type fire dampers.

C. Fire dampers penetrating floors and walls rated up to 2 hours shall be U.L. rated for 1-1/2 hours. Fire dampers penetrating floors and walls rated more than 2 hours shall be U.L. rated for 3 hours.

D. Fire dampers mounted in ceiling grilles and diffusers shall be Ruskin CFD-5A ceiling fire dampers with grille and diffuser radiation shields. Ceiling fire dampers shall be UL Fire Resistance Classified. The fire damper located in the neck of the grille or diffuser shall be a fusible volume adjustment. The fire damper shall be furnished with a factory fabricated ceiling diffuser radiation shield. The entire system shall be UL Classified for use in all UL fire rated roof/ceiling systems with fire resistance ratings of three hours or less.

E. Equal fire dampers by Air Balance, Potroff, Nailor, NCA, or accepted equal.

2.2 COMBINATION FIRE/SMOKE DAMPERS

A. Combination fire/smoke dampers shall be provided with optional 250°F firestat. Combination fire/smoke dampers shall be equipped for vertical installation in walls. Dampers shall possess a 1-1/2 hour U.L. label for installation in fire partitions rated at 2 hours or less or 3 hour U.L. label for installation in fire partitions rated at 3 hours or more, see architectural drawings.

B. Combination Fire/smoke dampers rated for 1-1/2 hour shall be Ruskin model FSD60. Equal fire dampers by Air Control Products, or Leader Industries will be accepted. Fire dampers in walls behind wall mounted grilles or diffusers shall be type "A".

C. Equal fire dampers by Air Balance, Potroff, Nailor, NCA, or accepted equal.

2.3 GRILLES AND DIFFUSERS

A. Unless otherwise indicated, color and finish to be as selected by Architect.

B. Maximum noise level on any unit shall be at least 5 less than noise criteria level (NC) for which room is designed unless otherwise indicated. Room NC to be assumed to be 35 unless known. Maximum pressure drop shall not exceed 0.1" w.g. unless otherwise noted.

C. Grilles and diffusers shall be Price model numbers listed in schedule on drawings or equal by Krueger, Carnes, Metalaire, Titus, Nailor, Tuttle & Bailey, or approved equal.

D. Ceiling supply diffusers and return grilles shall be furnished with seismic clips for connection of seismic cables.

2.4 CONTROL DAMPERS

A. Dampers to Ruskin model CD-60, airfoil blade, low leakage or Air Balance, Inc. model AC-516 or equal by Dowco AWM, Leader Industries, Pottorff, or approved equal.

B. Damper frame and blades shall be 16 gauge galvanized steel. Bearings shall be molded synthetic. Finish shall be mill galvanized. Leakage on a 24" wide damper shall not exceed 5.8 CFM per square foot.

2.5 BALANCING DAMPERS

A. Manual balancing dampers shall be Ruskin model MD-35 or equal by Air Balance, Prefco, American Warming, Safe Air, Leader Industries, Pottorff, or approved equal.

B. Dampers shall be opposed blade, positive lock, non stick, non corrosive, internally braced constructed of steel. Provide damper with 3/8" square steel control shaft without operator.

2.6 LOUVERS

A. Fixed louvers shall be Ruskin model EME 520DD wind driven rain resistant drainable blade louver or equal by United Entertech, Pottorff or NCA.

B. Louvers shall be boxed type for new construction and shall be flanged type for existing construction. Louvers shall be 6" deep and furnished with expanded flattened aluminum birdscreen, 3/4" X 0.51". Water penetration shall not exceed 0.02 ounces of water per square foot of free area at 1000 feet per minute free area velocity.

C. Louver shall be a extruded aluminum louver with a factory applied Kynar resin coating of a color as selected by Architect. Liquid coatings shall be factory applied to properly cleaned, pretreated and primed metal substrates and then oven baked. Submit color and finish sample chart to Architect for selection.

D. Furnish each louver with an all-aluminum construction backdraft damper or motorized damper as shown on the drawings.

PART 3 – EXECUTION

3.1 FANS AND ROOF VENTS

A. Install each fan in accordance with manufacturer's written installation instructions.

B. Suspend ceiling exhaust fans from building structure with threaded rods and vibration isolators.

C. Provide seismic sway cables for each ceiling exhaust fan at each support point and connect to building structure.

D. Attach pre-fabricated roof curbs for roof exhaust fans and roof vents to building structure in accordance with the seismic requirements.

E. Provide hold downs for each roof exhaust fan and roof vent for a seismic connection of fan or vent to curb in accordance with the seismic requirements.

3.2 FIRE DAMPERS

GREENWOOD SCHOOL

A. Fire dampers shall be installed in wall openings or floor openings utilizing steel sleeves, angles and other materials and practices required to provide an installation equivalent to that utilized by the manufacturer when dampers were tested at U.L. Installation shall be in accordance with damper manufacturer's written installation instructions.

B. Fire damper shall be sized so that the free area is not less than the connected duct free air space.

C. Refer to Architectural drawings and provide fire dampers in ducts penetrating rated walls or ceilings.

3.3 GRILLES AND DIFFUSERS

A. For air balancing purposes, provide a opposed blade balancing damper with key operator for all grilles and diffusers.

B. Install grilles and diffusers in accordance with manufacturer's recommendations and installation instructions. Mount all units securely to ducts and/or building construction in an approved manner.

C. Ceiling units to be arranged to make uniform pattern with lighting fixtures. See architect's reflected ceiling plan.

D. Provide seismic sway cables at each ceiling grille or diffuser seismic clip and connect to building structure in accordance with the seismic requirements.

END OF SECTION 23 34 00

SECTION 23 81 43 MECHANICAL; HVAC, PACKAGED HEAT PUMPS

PART 1 - GENERAL

1.1 The provisions of the GENERAL CONDITIONS OF THE CONTRACT, the SUPPLEMENTARY CONDITIONS, and Section 23 00 00 Mechanical General of the Specifications, apply to the work under this Section to the same extent as if fully included herein.

1.2 All equipment and materials for this project shall be purchased from and furnished to the contractor by the manufacturer's local representative for Mechanical Design, Inc. No submittals for equipment or materials will be received where the local representative has not originated the submittal data for this project. All non-compliant submittals will be promptly rejected.

1.3 Provide packaged heat pump units as shown on plans. Cooling and heating capacities shall be as listed on schedule on drawings. The unit shall be properly assembled and tested at the factory. It shall be designed for use with Refrigerant R410A.

1.4 Cooling capacity ratings shall be based on ARI standards.

1.5 Packaged heat pumps shall be tested in accordance with UL 559 or UL 1995.

1.6 Packaged heat pumps shall be Trane models listed on drawings, or equal by Carrier or accepted equal

PART 2 – PRODUCT

2.1 Provide horizontal packaged, one piece, air-to-air electric heat pumps designed to function as a year round air conditioning system. Units shall be completely assembled and tested complete with refrigerant charge and ready to operate. The total unit shall listed by U.L. and carry a U.L. label.

2.2 All wiring internal to the unit shall be colored and numbered for identification.

2.3 All units shall be provided with condenser coil guards.

2.4 Electric resistance heaters shall be internally wired nickel chromium elements with controls necessary for complete operation. Safety controls shall include primary high temperature and over current protection. Heaters shall be U.L. listed and shall comply with N.E.C.

2.5 **Economizer (Units larger than 5 tons)**

A. The assembly includes fully modulating 0-100 percent motor and dampers, minimum position setting, preset linkage, wiring harness with plug, spring return actuator and fixed dry bulb control. The barometric relief shall provide a pressure operated damper that shall be gravity closing and shall prohibit entrance of outside air during the equipment off cycle. The unit shall be furnished with barometric relief.

B. Differential enthalpy control shall be provided for either factory or field installation.

2.6 **REFRIGERATION CIRCUIT**

A. Unit compressors shall be welded fully hermetic reciprocating with crankcase heaters and suitable vibration isolators. Compressors shall be of same manufacturer as unit and shall be tested and designed in unit to operate down to -20°F outdoor air temperature on the heating cycle without shutting off. The standard unit shall be capable of operating down to 35°F outdoor air temperature on the cooling cycle. Compressors shall have a five year non-prorated warranty. Where noted in schedule on drawings, provide low ambient kits to allow cooling operation to 0°F.

B. Units shall provide space neutral air in dehumidification mode. Unit(s) shall consist of insulated weather tight casing with compressor(s), air cooled condenser coil, condenser fans, evaporator coil, hot gas reheat coil and refrigerant diverter valve, subcooling condenser circuit, return air filters, supply motors and unit controls.

1. Unit shall incorporate factory mounted on/off (Modulating) hot gas reheat coil capable of reheating cooled air to space neutral temperatures. Unit shall incorporate refrigerant diverting valve capable of diverting refrigerant to reheat circuit or condensing circuit as necessary.
2. Unit shall divert refrigerant as necessary to the hot gas reheat coil in the supply airstream when in dehumidification mode to reheat dehumidified supply air to space neutral temperature.
3. Unit shall use refrigerant subcooling circuit in condensing section as necessary to maintain dehumidification capacity, supply air temperature, and unit efficiency.

2.7 Indoor and outdoor coils shall be aluminum plate fins mechanically bonded to seamless copper tubes.

2.8 Fans and Motors: Indoor air fan shall be forward curved, double width, double inlet, centrifugal type. Belt driven unit motor pulleys shall be adjustable pitch. Indoor fan motor shall have permanently lubricated bearings. Outdoor fans shall be propeller type with direct driven permanently lubricated motor. Fans shall discharge upward. Indoor and outdoor fans shall have internal thermal overload protection.

2.9 Unit cabinet shall be constructed of galvanized steel, phosphatized, and finished with an air-dry paint coating with hinged access panels. Structural members shall be 16 gauge with access doors and removable panels of minimum 20 gauge. Cabinet interior shall be insulated with 2" thick neoprene-coated fiberglass. Cabinet panels shall have hinged access for service to all operating components. A condensate drain for the indoor coil shall be provided.

2.10 Safety Controls: The heat pump heating/cooling system shall be protected with high pressurestat, low pressurestats, loss-of-charge protection, indoor coil freezestats, and current and temperature sensitive overload devices. Each of these devices shall be wired to prevent compressor restart. Two-compressor units shall have separate and independent refrigeration and control systems designed to allow for standby operation of either compressor if one is locked out. Two-compressor units shall have 2-stage compressor heat and cool with built-in electric strip heat lock out to prevent resistance heat operation above 40 F ambient.

2.11 An outdoor coil defrost system shall be incorporated into the base unit to prevent frost accumulation during heating cycle. The defrost cycle shall function on the basis of time and coil temperature. A 90-minute timer shall actuate a defrost mode only if coil temperature is low enough to indicate a heavy frost condition. Defrost shall have a positive termination time of a maximum of

10 minutes or when the defrost thermostat is satisfied to prevent prolonged operation on a defrost cycle. Electric resistance heaters shall operate automatically during the defrost cycle.

2.12 Thermostats shall be dual setpoint/automatic changeover with fan control. Thermostats shall be programmable with Aoccupied@ heating and cooling temperature setpoints, and unoccupied heating and cooling temperature setpoints. Thermostats shall be furnished with equipment and bear the same name as the rooftop heat pump components.

2.13 Emergency heat control shall consist of emergency heat control box containing emergency heat relays and outdoor thermostats; and an emergency heat thermostat subbase (with warning light). Control shall allow for manual bypass of compressor and outdoor thermostats if compressor becomes inoperative, or for service. Outdoor thermostats shall provide for staging of electric resistance heat according to outdoor temperature. Thermostats shall be wired into the electric heater contactors and shall have an adjustable set point to provide economical resistance heat staging.

2.14 Time delay circuit to prevent compressor short cycling as a result of a rapid change in thermostat setting and automatically prevents compressor restart at least 5 minutes after shutdown.

2.15 Provide for each stage of electric heat on outdoor thermostat to lock out electric heat when outdoor temperature is below its setpoint. Provide emergency heat switch on thermostat to bring on heat if the compressor fails.

2.16 Fresh Air Intake Hoods:

A. Provide units larger than 5 tons with fresh air intake hood with modulating motor operated damper capable of 100% economizer operation. The unit shall have a differential enthalpy controller to initiate the economizer sequence otherwise controlled by a CO2 sensor and occupied/unoccupied schedule.

B. Provide units 5 tons and smaller with fresh air intake hood with modulating motor operated damper capable of 25% outdoor air. The outdoor air damper shall be controlled by a CO2 sensor and occupied/unoccupied schedule.

2.17 The unit shall be controlled by a sensor furnished by the EMS contractor. Unit control wiring shall enable or disable the following instructions as a minimum:

A. Compressor operation and staging.
B. Evaporator fan control and fan only operation.
C. Limit the operation of electric heat during warm up period from unoccupied to occupied mode or temperature set point alteration.
D. Economizer or fresh air operation.
E. Initiate a de-humidification sequence.

2.18 DRAIN PAN

23 81 43

Provide slopped stainless-steel drain pan with a threaded stainless-steel outlet under evap. coil.

2.19 CONDENSER COIL GUARDS

Provide units with condenser coil hail guards. PERFORATED PANELS ARE NOT ACCEPTABLE.

PART 3 – EXECUTION

3.1 Provide an aluminum prefabricated roof curb for each unit. Curb shall be sloped so top of unit is level. Verify slope of roof with Architectural drawings and specifications prior to ordering curb. Installation of roof curbs is not included under Division 23.

3.2 Mount units on curbs provided rooftop manufacturer. Install unit per manufacturer's written installation instructions. Curbs shall be attached to the roof deck, below the roof insulation, as required to comply with the seismic requirements of the International Building Code. Install unit per manufacturer's written installation instructions.

3.3 Provide hold downs between rooftop units and curb to comply with the seismic requirements of the International Building Code.

3.4 Provide construction filters. Change to 2" pleated MERV 13 throwaway type after substantial completion.

3.5 **CONDENSATE DRAIN PIPE**

A. Provide 3" deep Type L copper P-trap at connection to condensate drain. Pipe full size condensate drain pipe from rooftop unit down to nearest roof drain.

B. Support pipes from existing roof on 8'-0" centers with closed-cell polyethylene pipe pier as manufactured by Michigan Hanger. Include pipe clamp to secure pipe to pipe pier. Provide 3 layers of roofing felt below pipe pier with hot mopped pitch.

3.6 Set the open position of the outside air hood motorized damper at O.A. CFM listed in schedule on drawing.

END OF SECTION 23 81 43

SECTION 25 55 00 - AUTOMATIC TEMPERATURE CONTROLS

PART 1 – GENERAL

1.1 The provisions of the GENERAL CONDITIONS OF THE CONTRACT, the SUPPLEMENTARY CONDITIONS, and Section 23 00 00 Mechanical General of the Specifications, apply to the work under this Section to the same extent as if fully included herein.

1.2 All equipment and materials for this project shall be purchased from and furnished to the contractor by the manufacturer's local representative for Mechanical Design, Inc. No submittals for equipment or materials will be received where the local representative has not originated the submittal data for this project. All non-compliant submittals will be promptly rejected.

1.3 The Temperature Controls and Building Management System Hardware will be furnished under this contract. All controls equipment shall be Automated Logic to match the existing system. Approved contractors to bid this project are:

1.4 Harris Integrated Solutions, Inc.
304 Parnell Street
West Columbia
803-794-8808

1.5 The mechanical contractor shall coordinate closely with the control's contractor and electrical contractor in order to insure a complete and operating system.

1.6 **SUBMITTALS/DRAWING**

A. The Control System Contractor shall submit prior to installation a set of installation drawings and control strategies for review by the consultant and/or owner's representative. These drawings shall include the physical location of building control system equipment and system architecture. The complete sequence of operation of the control system shall be provided.

B. Upon System completion of the installation and final system adjustment, the Control Contractor shall provide a full set of as-built drawings of the installation and the control strategies.

C. Framed control diagrams shall be mounted on the wall inside the appropriate mechanical room.

1.7 **GUARANTEE:**

A. The entire control system shall be installed by the control system contractor and guaranteed free of defects and shall include required servicing and maintenance for one year after final acceptance.

B. The entire building shall be controlled by a direct digital control (DDC) system. The DDC system and all associated components shall carry a one year warranty on labor and materials from date of acceptance by the Owner. Any equipment, software or labor found to be defective during this period shall be repaired or replaced without expense to the Owner. Provide Owner operation support at no additional expense during the warranty period.

C. The control company shall provide for 24 months after project closeout, all programming, troubleshooting assistance required and refresher training for the Owner to operate and program the DDC control system. The control company shall make available 24 hour, 7 days

per week support to the Owner during this 24 month period. The control company shall respond to the Owner by computer interface within 60 minutes of initial contact.

1.8 Motor starters shall be furnished by the mechanical contractor and turned over to the electrical contractor for mounting and power connections through starter to motor. The contractor shall furnish starters, disconnects or combination starter/disconnects as shown on the electrical drawings. Refer to the electrical drawings for the type required for each piece of equipment. Mounting and wiring of starters including wiring to equipment shall be provided under electrical section of the specifications.

1.9 SCOPE OF WORK

A. Provide a complete and operational system per the bid documents and specifications. Provide all labor and materials for a functional controls system that meets all aspects of the intent regardless of whether specific parts and pieces are specified.

B. Provide connection to and integration of new controls with the District controls system.

PART 2 – PRODUCTS

2.1 **CONTROL AND INTERLOCK WIRING:**

A. All electrical work required under this section of specifications shall comply with the latest National Electrical Code. Control system power supply shall be served by a separate breaker and fused in control center for secondary protection.

B. All control wiring shall be run in rigid conduit below grade or, on outdoor installation. All control wiring in walls or above the ceiling (or in equipment rooms where permitted by electrical specifications) shall be run in galvanized EMT. PLENUM CABLE WILL NOT BE ACCEPTED.

C. Control wiring shall be color coded #16 TFF of TFFN wire with 600 volt insulation. Run all wiring between terminal points without changing color. Color code of control wiring shall be as indicated on control wiring diagram. Multi-conductor thermostat cable will not be acceptable.

2.2 **TRAINING/OWNER'S INSTRUCTION**

The Control System Contractor shall provide two copies of an operator's manual describing all operating and routine maintenance service procedures to be used with the system. The Control System Contractor shall instruct the Owner's designated representatives in these procedures during the start-up and test period. These instructions are to be conducted during normal working hours.

2.3 **TELECOMMUNICATIONS CAPABILITIES**

A web-based interface shall be furnished as necessary to allow direct connection of the Building Management and Control System to public and private networks. The interface shall have automatic capabilities to allow it to be accessed from a remote control computer or terminal. The interface unit shall be able to allow the person access to any information on the network, provided that the standard log-on security screening is met.

2.4 **EXECUTIVE PROCESSOR**

A. The executive processor can be installed in any convenient location in the building. The processor will gather all "global" information for distribution to the field control modules. The processor will meet the following requirements:

1. All communications between the central processor and the field control modules will be done by means of direct digital control (DDC) and will comply with the limits for Class A and Class B computing device pursuant to Subpart J of Part 15 of FCC rules. All communications will be half-duplex, binaryencoded using proprietary protocol, with the executive processor continuously polling the field control modules using cyclic redundancy checking for error detection and correction. In the event communications is lost, the field control modules will be capable of "stand alone" control or will go to default control values.

2. All communications between the executive processor and central operator computer will conform to EIA standard RS-232-C and ANSI standard X3.4/(ASCII). Communications will be via direct connection to processor communication port or connection of optional full-duplex Bell 103 or 212 compatible modems. Transmission rate will be software selectable to 110, 300, 600, or 1200 bps. Local communications will be password protected with three levels of access. The first level will allow status interrogation only. The second level will allow temporary changes to schedules and setpoints in addition to status interrogation. The third level will allow permanent changes to all parameters.

3. The executive processor will gather, process and distribute all global information as required by field control modules. This global information will be as follows:

   (1) Outdoor Air Temperature
   (2) Zone Temperatures
   (3) Electrical KW Usage
   (4) Temperature Drift Alarms
   (5) Status of all Control Outputs

   This global information will initiate software defined sub-routines within the executive processor. These "event" programs will be user defined, limited or expanded to control all field control modules.

4. The executive processor will maintain, update and communicate resident programs to all field control modules. These resident programs will be battery backed up for a minimum of 90 days and will require no operator interface to resume control functions following a power outage. The resident programs will consist of the following:

   (1) Time of Day and Holiday Scheduling:
   Provide group and individual schedules for each of the field control modules. This schedule will provide a minimum of three (3) on-off periods per day and up to 16 holidays of any number of consecutive days.

   (2) Electric Demand Limit:

   The demand control program will contain a load shed register with two (2) levels of priority assignments. Demand peak will be limited by shedding zones. Control will be based on 30 second integration of demand, the rate of increase or decrease and the historic effects of load shedding and restoring. Minimum on-times, minimum off-times, maximum off-times, and room temperature discomfort thresholds will be part of the demand limit program. Pulse meter to be furnished and installed by Local Power Company and paid for by the vendor.

   (3) Optimized Start/Stop:

Morning start and afternoon stop times will be adjusted by the optimum start/stop program. Each zone will have an individual program and individual setback/setup temperature. Local override will be possible in each zone to restore the zone to setup temperatures. Optimized start and stop times along with recovery and thermal coefficients will be updated daily and stored in a data log.

(4) Data Logs:

The central processor will gather and store all data log information. These logs will reside in the battery backed up memory and can be accessed locally or transferred to a remote terminal. A separate log will be maintained for each of the following:

(a) Alarms
(b) Zone temperatures
(c) Optimized start/stop times
(d) Run times for all equipment
(e) Percentage activation of control parameters
(f) Power Consumption and Peak Demand

2.5 **INPUT-OUTPUT MODULE**

A. The IOM will be a complete stand-alone controller and will operate on default values if communication is lost with the executive processor. The control action will be PID (proportionalintegral-derivitive). The IOM will also contain the resident program and data acquisition for optimum start/stop, run time logs and timed override logs. Alarms will be reported to the central processor for temperature drift limit, communications problems or user definable inputs.

B. All setpoint and function adjustments will be made at the central processor. No adjustment will be possible at the IOM other than initiation of the timed override function.

C. The IOM will provide eight (8) control outputs that will be user definable and will be either digital or analog.

D. The IOM will provide eight (8) control inputs that will be user definable and will be either digital or analog.

E. Any input can be sequenced to an output or linked to any other control point in the system.

F. The IOM will have "on-off-auto" switches to override any output for manual operation.

G. Analog inputs will accept proportional 4-20 milliampere current signals from external 2-wire sensor/transducer. Digital inputs will be software selectable for dry contact closures or digital pulse accumulation.

H. Analog outputs will employ a selectable range from 4-20 milliamps, 1-5 volts dc or 2-10 volts dc. Digital outputs will be software selectable to produce either held or momentary contacts or employ the use of PWM (pulse width modulation) for positioning.

I. Status lights will provide confirmation of system communications, function and output status.

2.6 **ELECTRONIC THERMOSTAT MODULES**

A. The ETM will be a complete standalone controller and will operate on default values if communications is lost with the central processor. The control action will be PID (proportionalintegral-derivitive). The ETM will also contain the resident program and data acquisition for optimum start/stop, run time logs and timed override logs. Alarm will be reported to the central processor for temperature driftlimit problems.

B. All setpoint and function adjustments will be made at the central processor. No adjustments will be possible at the ETM other than to initiate the timed override circuit.

C. Status lights will provide confirmation of system communications, function and output status.

D. Outputs will be as follows:

1. Fan
2. Cool 1
3. Cool 2
4. Heat 1
5. Heat
6. Economizer
7. Dehumidification

E. Inputs will be as follows:

1. Space temperature
2. Timed override
3. Air flow failure

2.7 **TERMINAL BOX CONTROLLERS**

A. A terminal box controller shall be provided to control each zone damper to maintain the appropriate space temperature required. All setpoint adjustments shall be made through the executive processor or the central computer.

B. The terminal box controller programmable settings shall include:

1. Cooling and heating setpoints for both scheduled on periods and off periods.
2. heating and cooling outputs.
3. Damper control and damper override.
4. Timed local override of setback operation.

C. The terminal box controller shall communicate with the executive processor and central computer to allow the following:

1. Time of day scheduling
2. Optimized start/stop
3. Run time logs for operation of heating/cooling stages
4. Equipment alarms for temperature drift and box malfunction
5. Self-diagnostics for hardware and software faults or communications loss

2.8 **SMOKE DETECTORS**

A. Provide integration to a self-contained smoke detector located in the return air duct downstream for all air handling units rated above 2,000 CFM capacity and for all units serving a rated "nonsprinkled" means of egress regardless of CFM capacity. (This is generally shown, but not limited to symbol SD) Smoke detector shall be installed in accordance with NFPA 90A and NFPA 72E.

B. Provide integration to a self-contained smoke detector located in the supply and/or return air ducts terminating in any means of egress as shown on the drawings. (This is generally shown, but not limited to symbol FSD).

C. Detector shall stop the air handling unit (10 seconds or less), close any associated smoke dampers, energize red alarm light and send alarm to the central fire alarm system. Ionization detector shall be addressable type detector compatible with the automatic fire alarm system. Provide additional control relays if required to shut down air handler in the specified time. **Coordinate with fire alarm supplier as to type required for integration to fire alarm system**. See detail on drawings for coordination.

2.9 **COMBINATION FIRE/SMOKE DETECTORS**

A. The detector for the combination fire/smoke damper shall be provided by the electrical contractor and installed by the mechanical contractor. This shall include mounting and control interlock wiring. Connection to fire alarm system and power wiring for all detectors shall be provided by the electrical contractor.

B. Detector shall close the associated damper, stop the air handling unit, energize red alarm light and send alarm to the central fire alarm system. Ionization detector shall be compatible and fully integrated with the fire alarm system. Coordinate with fire alarm supplier as to quantity and location as required for integration to fire alarm system. Alarm light and remote reset shall be visible from the floor without raising ceiling panels.

2.10 **DAMPER OPERATORS**

A. All damper operators shall be two-position or proportional as indicated. They shall be furnished in sufficient numbers and with sufficient power to insure satisfactory operation of the damper to provide tight close off. They shall be spring return type to return the damper to the normal positions indicated. Mark full open and full closed positions of all dampers. Marks shall be made with Bakelite nameplates, attached to ductwork.

B. Dampers to Ruskin model CDRS25 with neoprene blade seal.

C. Damper frame and blades shall be galvanized steel. Bearings shall be molded synthetic. Finish shall be mill galvanized.

PART 3 – EXECUTION

3.1 **SEQUENCES OF OPERATION**

A. **Rooftop Units**

1. A unit controller shall be provided for each unit. The controller shall enable the unit for operation according to its individual occupied/unoccupied schedule. The controller shall

control the unit stages of heating, VFD and cooling sequence to maintain the space temperature set points.
Supply air temperature shall be 55□F (adjustable); the maximum shall be 110 □F (adjustable).
Provide a PID program and time delays as required to prevent cycling of controls.

2. A room temperature sensor located in the space shall control the compressor staging and the variable speed drive based on deviation from set point to maintain space temperature.

3. The motorized outside air damper shall remain closed during all unoccupied times. The motorized outside air damper shall remain closed upon the initial start up of the unit. After the room has reached its warm-up or cool-down temperature, the outside air damper shall open to its minimum position based on occupancy schedule.

4. When commanded to change over to the Occupied Mode, the unit controller shall enable unit operation to a pre-determined heating/cooling set point (adj). Provide a custom program in the RTU controller for occupied control:

   (1) Occupied - The unit will be enabled to operate at the pre-determined heating/cooling setpoint (adj) and OA Damper will modulate from zero to the OA setpoint. The fan shall operate continuous or cycle with heating/cooling as selected in the EMS system.

5. When commanded to change over to the Unoccupied Mode, the unit controller shall raise the cooling set point and lower the heating set point to an operator determined value (adj). Provide a custom program in the controller for unoccupied control:

   (1) Unoccupied - The unit will stop and the fresh air damper will close. A drop in temperature below the unoccupied set point of the room thermostat will initiate a night cycle program to maintain setting. A rise in temperature above the unoccupied high limit will initiate a night cycle program to maintain setting.

   (2) During the Unoccupied Mode, the unit controller may be reset to the Occupied Mode for an operator determined time period. This reset shall be activated by a signal from a local override switch on the room temperature sensor or by command from the operator's terminal. At the end of the operator determined time period, the terminal equipment controller shall return to the Unoccupied Mode.

6. When the relative humidity is above the set point 60% (adj) as sensed by the space humidity sensor, the unit will be overridden to full cooling. The hot gas reheat modulates to maintain neutral air temperature. The unit returns to normal operation when the relative humidity falls below 60%.

3.2 **HARDWARE INSTALLATION**

A. Provision of a voice-grade telephone line and a phone terminal is the Owner's responsibility. The Contractor shall be responsible for communication wiring between the phone terminal and the modem/Gateway.

B. Wiring

1. Install all power and communication wires to/from Control modules.
2. Install wires for the room temperature sensors, from sensor to the appropriate control module.
3. Install all sensing devices and the wiring to module.

4. Install all control and monitoring wiring.
5. Wire and terminate CMs for each piece of equipment.

C. Provide immersion wells, pressure tapping, and any associated shut-off cocks.

D. Provide all in-line devices, such as flow meters, flow switches, and control valves.

3.3 Provide automatic shutdown of kitchen exhaust and make up air fans in accordance with NFPA complete and ready for use.

3.4 Thermostats and other operable devices accessible to the public or faculty shall be mounted at ADA heights per ANSI.

3.5 **CERTIFICATION**

Furnish to engineer two copies of certifications signed by authorized representative that:

A. Control system has been checked-out and operates according to drawings and specifications.
B. All controls are guaranteed unconditionally for two years from date of acceptance and will be serviced for this period free of charge.
C. Maintenance personnel or responsible party has been instructed as to the operation of control system.

3.6 **DEMONSTRATION**

The contractor shall provide a demonstration of the system hardware and software for the school district within 60 days of contract award. The presentation shall include mock-up control of equipment and all other functions as specified. The presentation shall be coordinated through the Mechanical Engineer and will be held at the convenience of the school district.

END OF SECTION 25 55 00

PART 1 - GENERAL REQUIREMENTS

1-01 SCOPE OF WORK

WORK INCLUDED: Furnish all necessary labor, material, plant and equipment, including materials and equipment not specifically mentioned but necessary to complete the work in a neat, correct, and workmanlike manner, to include:

1) Electrical service, complete to the point of connection with the utility company's facilities.
2) Service entrance equipment.
3) Feeders, panelboards, and distribution equipment.
4) Complete branch circuit wiring system for lighting, receptacles, equipment, and outlets.
5) Lighting fixtures, wall switches, receptacles and outlets.
6) Line voltage connections to equipment furnished under other Sections of these specifications, including disconnects, where indicated.
7) Hangers and Supports for Electrical Systems, see Section 260529.

SPECIAL NOTE: The provisions of the Instructions to Bidders, General Conditions, Supplementary General Conditions and all applicable requirements of Division 1 shall govern the work under this Division the same as if incorporated herein.

1-02 EQUIPMENT WIRING

Furnish and install power circuits to and line voltage connections to all equipment furnished and installed by other trades, including disconnects, where indicated. Disconnect switches to be furnished, installed, and wired under Division 26 unless noted otherwise in the Design Documents.

VOLTAGE: The Electrical Contractor shall supply power to equipment at the voltage indicated on the electrical drawings. The Electrical Contractor and the other applicable trades will be held responsible for coordinating the equipment voltages, the control equipment wiring, and the location and type of disconnect required to comply with the equipment manufacturer's requirements, the National Electric Code, and applicable local building codes. IF EQUIPMENT IS SUPPLIED AT A
VOLTAGE OTHER THAN THAT PROVIDED, THE GENERAL CONTRACTOR AND SUBCONTRACTORS WILL BE HELD RESPONSIBLE FOR MAKING ANY NECESSARY ADJUSTMENTS TO CORRECT THE CONFLICT, AT NO COST TO THE OWNER, TO THE SATISFACTION OF THE ELECTRICAL ENGINEER.

1-03 EXISTING CONDITIONS

The Contractor will be held responsible for having visited the site and having familiarized himself with the existing conditions prior to submitting his bid.

1-04 COORDINATION

OTHER TRADES: All work under this Section shall be coordinated with other trades to ensure proper location of outlets and equipment connections, and to minimize conflicts with structural members, duct work, piping, etc. Conflicts between equipment and/or material locations shall be corrected as directed by the Architect-Engineer at no additional cost to the Owner.

UTILITIES: The service locations, arrangement and metering for electrical and telephone service entrances shall be coordinated in detail with those utilities. All provisions necessary for these services shall be provided in the Electrical Contractor's bid, unless otherwise indicated.

1-05 CODES AND PERMITS

Installation and materials shall be in accordance with the applicable versions of the National Electrical Code, the International Building Code, and all local codes. Apply and pay for all permits and fees required for this construction.

1-06 DRAWINGS

The drawings and specifications shall be considered as complementary, one to the other, so that materials and labor indicated, called for, or implied by either shall be furnished and installed as if required by both. Where a disagreement exists between the plans and specifications, the item or arrangements of better quality, greater quantity, or higher cost shall be included in the base bid. Any discrepancies between the drawings, specifications, and field conditions shall be resolved with the Engineer prior to commencing work. All agreements shall be verified in writing.

RECORD DRAWINGS: The Contractor shall maintain one set of clean blueprints for "RECORD" drawings. All changes, revisions, or modifications to the project shall be recorded daily on these drawings with **redline pencil**. Upon completion of the project, these redline drawings shall be scanned to PDF electronic files and turned over to the Architect/Engineer for review. Submit PDF electronic files of scanned Record Prints and one set of file prints. All changes, revisions, or modifications on the redline drawings provided to the Engineer shall be noted in red or shall be highlighted in yellow. **Failure to comply with the above criteria may result in rejection of the Record Drawings by the Architect-Engineer.**

1-07 MAINTENANCE AND OPERATING MANUALS

The Contractor shall furnish the Owner two (2) complete maintenance and operating manuals for each piece of equipment and material furnished under this project. These manuals shall be bound in hard cover binders with tabs for each section item or piece of equipment. The manuals shall be furnished to the Engineer prior to the final observation, and final acceptance shall not be given until the Owner's maintenance personnel are instructed in maintenance and operation of all systems.

1-08 GUARANTEE

All materials and labor furnished under this Section of the specifications shall be guaranteed by the Contractor to be free from defects for a period of one year from the date of acceptance. The Contractor shall repair or replace any deficiencies reported in the guarantee period promptly after notification, without any additional compensation from the Owner. LED lamps are included in this warranty. Incandescent, fluorescent, & HID lamps are excluded from this warranty, except that all lamps shall be operational on the date of acceptance.

1-09 MATERIALS

UL LISTING: All materials shall be listed by Underwriter's Laboratories, or an approved equal testing laboratory, and shall bear the "UL" Label, where applicable.

SUBSTITUTIONS: Specific reference in the specifications to any article, device, product, material, fixture, form or type of construction, etc., by name, make or catalog number, with or

without the words "or equal" shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition and the Contractor in such cases may, at his option, use any article, device, product, material, fixture, form or type of construction, which in the judgment of the Architect-Engineer, expressed in writing prior to bidding as specified below, is equal to that herein named.

Requests to substitute materials or equipment considered by the Contractor as equal to those specified shall be submitted for review to the Architect-Engineer ten (10) days before bids are taken. Requests shall be accompanied by samples, descriptive literature, and engineering information, as necessary to fully identify and appraise the product. No increase in the contract sum will be considered when requests are not accepted. If the item is found to be equal, the Architect-Engineer will issue an Addendum making it a part of the Contract Documents prior to bidding.

1-10 SUBMITTALS

Electrical shop drawings shall be submitted in one complete package containing all items required by this specification and all other Division 26-28 specifications. Partial shop drawing submittals may be rejected by the Architect-Engineer.

Exceptions: Fire Alarm System CAD drawings, Lighting Control System CAD drawings, and Allowanced Light Fixtures may be submitted separately if additional time is needed to prepare these shop drawings.

Refer to Section 260510 - Electrical Submittals for additional information.

PART 2 - MATERIALS

2-01 GENERAL REQUIREMENTS

COORDINATION: Coordinate arrangement, mounting, and support of electrical equipment to allow maximum possible headroom (unless specific mounting heights that reduce headroom are indicated), to provide for ease of disconnecting the equipment with minimum interference to other installations, to allow right of way for piping and conduit installed at required slope, and so connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

ELECTRICAL ROOM LAYOUT: Submit an Electrical Room layout drawing for each Electrical Room reflecting dimensions of actual equipment provided. Provide clearances per table 110.26(a)(1) of the NEC.

2-02 GROUNDING

INSULATED CONDUCTORS: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

BARE COPPER CONDUCTORS:

1) Solid Conductors: ASTM B3.
2) Stranded Conductors: ASTM B8.

3) Tinned Conductors: ASTM B33.
4) Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5) Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6) Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7) Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2-03 RACEWAYS AND FITTINGS

GALVANIZED RIGID CONDUIT (GRC): UL 6 and ANSI C80.1 with full weight screwed fittings. Bushings shall be malleable iron. Bushings 1 1/4" and larger shall have insulated throat and grounding lug.

INTERMEDIATE GRADE METALLIC CONDUIT (IMC): UL 1242 and ANSI C80.6, galvanized, with full weight screwed fittings. Bushings shall be as specified above.

ELECTRICAL METALLIC TUBING (EMT): UL 797 and ANSI C80.3 with steel compression or setscrew type fittings. Die-cast fittings are not acceptable. Fittings 1 1/4" and larger shall have nylon insulated throat. Indented or drive-on fittings are not acceptable. Conduit used for Fire Alarm System wiring shall be red, similar to Allied Fire Alarm EMT.

FLEXIBLE STEEL CONDUIT (GREENFIELD): UL 1. Fittings shall be steel.

LIQUIDTIGHT FLEXIBLE STEEL CONDUIT (SEALTITE): UL 360. Fittings shall be steel compression type.

PLASTIC CONDUIT (PVC): Schedule 40 polyvinylchloride. NEMA Standard TC-2 and TC-3 and UL Standards. Conduit, solvent, and fittings shall all be supplied by the same manufacturer. PVC is not permitted above grade.

SURFACE METAL RACEWAY (INDOOR): Wiremold V700 ivory surface metal raceway, or acceptable equivalent. Straps, boxes, elbows, etc. shall all be supplied by the same manufacturer. Total cross-sectional area shall be a minimum of 0.25 square inches.

2-04 WIRE AND CABLE

UL STANDARDS: UL 44 and UL 83.

CONDUCTOR: Copper, soft drawn, per ASTM B3 and comply with NEMA WC 70. Sizes No. 12 and 10 shall be solid conductor. Sizes No. 8 and larger shall have Class B concentric stranding per ASTM B8. Stranded conductors may not be used on No. 12 and No. 10 circuits.

INSULATION: 600 Volt, 90ºC rated, comply with NEMA WC 70. Type THHN-THWN-MTW, unless noted otherwise.

SPLICING MATERIALS:

No. 10 and smaller: Acceptable wire nuts or insulated crimped splice caps.
No. 8 and larger: Bronze or copper split bolts, or tinned compression connectors. (Polaris insulated splice blocks may not be used on this project).

Insulation shall be Scotch No. 23 rubber tape and Scotch No. 33 plastic tape, or approved equivalent method.

Power feeders shall not be spliced.

TYPE MC CABLE: Metal-clad cable, Type MC, rated 600 V or less, UL 1569, RoHS compliant, as manufactured by AFC, Encore Wire, or acceptable equivalent. Type MC Cable may not be used underground or under slab on this project.

TYPE MC-PCS CABLE: Metal-clad cable with Class 2 / Class 3 control cables, Type MC-PCS, rated 600 V or less, UL 1569, RoHS compliant, and meets NEC 725.136(I)(1) & NEC 725.136(I)(2). AFC MC Lite Luminary Series, Encore Wire M-LED Series, Southwire MC-PCS Duo, or acceptable equivalent. Type MC-PCS Cable may not be used underground or under slab on this project.

2-05 BOXES AND WIREWAYS

OUTLET BOXES: Galvanized sheet steel per UL 514. "Through-wall" boxes SHALL NOT BE USED. Back-to-back mounting of boxes is not permitted. All outlet boxes 4"x4" or smaller located on opposite sides of a rated wall shall have a minimum of 24" horizontal spacing or shall be protected with listed putty pads. All outlet boxes larger than 4"x4" (communications outlets, etc.) located in rated walls shall be protected with listed putty pads.

Box sizes shall be as follows:

1) Wall Receptacle Outlets: 4" square by 2 1/8" deep with plaster ring as required.
2) Wall Computer, Communications, Fire Alarm, and TV Outlets (up to 1” conduit): 4" square by 2 1/8" deep with one gang plaster ring. Provide box with 1” conduit knockouts where required.
3) Wall Computer, Communications and TV Outlets (1 ¼” conduit): 4 11/16" square by 2 1/8" deep with one gang plaster ring. Provide box with 1 ¼” conduit knockouts.
4) Ceiling outlets: 4" square or octagonal by 1 1/2" or 2 1/8" deep with stud or ears where required for fixture support.
5) Indoor Surface Mounted Outlets: Wiremold V5744S-2 surface metal box unless noted otherwise on the drawings (steel boxes and EMT conduit may be used in equipment rooms, janitor’s closets, storage rooms).
6) Exposed Outlets: Malleable iron or heavy duty cast aluminum with threaded hubs, Type FS, FD, or GS. Manufactured by Crouse Hinds, Appleton, Killark, or approved equal. Die cast boxes are not acceptable.

SUPPORT FOR RECESSED BOXES IN MASONRY WALLS: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

SUPPORT FOR RECESSED BOXES IN STUD WALLS: Support boxes from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Box brackets reliant on support legs pressed against back of opposing wall are not acceptable.

WIREWAYS, PULL BOXES AND JUNCTION BOXES: UL 50. NEMA 250, Type 12 unless otherwise indicated. Code gage galvanized sheet steel, aluminum, or steel primed and painted after fabrication. Manufactured by Square D, Austin Berryhill, Hoffman Engineering, B-Line Systems, or approved equal. Wireways shall have hinged covers.

2-06 WIRING DEVICES

MANUFACTURERS: All wiring devices shall be Hubbell Extra Heavy-Duty Specification Grade Series or equivalent of Arrow Hart Premium Industrial Spec Grade, Pass & Seymour Industrial Extra Heavy-Duty Spec Grade, or Leviton Industrial Spec Grade, unless specifically noted otherwise. If devices not meeting the specifications are supplied, they shall be removed, discarded, and new devices meeting the specification shall be furnished & installed by the Electrical Contractor at no cost to the Owner or the Engineer.

RECEPTACLES: 20A, 125V, 3 wire grounding, NEMA 5-20R, side and back wired, with impact resistant nylon face, Tamper Resistant (NEC 406.12), and standard color as selected by Architect. Duplex receptacles shall be listed Tamper-Resistant receptacles unless noted otherwise.

- "CR" denotes indoor Corrosion Resistant receptacle. Indoor Corrosion Resistant receptacles shall be listed Weather/Corrosion Resistant receptacles per NEC Article 406.8.
- "WP" denotes weatherproof receptacle. Weatherproof receptacles shall be listed Weather/Corrosion Resistant receptacles per NEC Article 406.8 and shall include an ExtraDuty rated “In-Use” style wet location cover with shallow lockable cover.

1) Duplex Receptacle, Tamper Resistant (NEC 406.12): Hubbell HBL-5362-TR, P&S TR63.
2) Duplex Receptacle, Corrosion Resistant (NEC 406.8): Hubbell HBL-5362-WR, P&S CR6300.

GFCI RECEPTACLES: Feed Thru type, 20A, 125V, NEMA 5-20R, standard color as selected by Architect. All GFCI Receptacles shall be self-testing and shall be listed Tamper Resistant (NEC 406.12) and Weather Resistant (NEC 406.8).

SWITCHES: 20A, 120/277V, side and back wired. Single pole, double pole, three way, or four way, as indicated on the drawings. Standard color as selected by Architect.

1) Single Pole Switch: Hubbell HBL-1221-X, P&S PS20AC1-X
2) Double Pole Switch: Hubbell HBL-1222-X, P&S PS20AC2-X
3) Three Way Switch: Hubbell HBL-1223-X, P&S PS20AC3-X
4) Four Way Switch: Hubbell HBL-1224-X, P&S PS20AC4-X

SPECIAL RECEPTACLES: Specification grade, rating as specified on the drawings.

COVER PLATES: Provide plates to suit the devices.

1) Finished interior walls: Jumbo Stainless Steel.

- Receptacles noted on drawings as dedicated for computers shall include a factory engraved jumbo stainless steel coverplate labeled “COMPUTER”. See Electrical Symbols and Power Plans on drawings to identify dedicated computer receptacle. 2) Exposed outlets: Galvanized steel.

3) Wet and damp locations: Weatherproof Extra-Duty rated “In Use” type with shallow (3” max) lockable clear cover, Legrand WIUCED10SC/WIUCED20CL, Eaton WIU1T1/WIU2DT1, Taymac MM42OC/MM242OC, or equivalent. Provide plate kits to suite devices.

2-07 LIGHTING AND LIGHTING CONTROLS

INTERIOR LIGHTING

1) FIXTURE SCHEDULE: See Drawings.

2) PRE-PAINTED STEEL: Fixture bodies manufactured from pre-painted steel shall be painted after fabrication, unless noted otherwise on the drawings.
3) LED LAMPS AND DRIVERS: Refer to Lighting Fixture Schedule and Lighting Fixture Schedule Notes on Drawings.
4) LENSES: Virgin acrylic plastic. Nominal thickness of fluorescent fixture lenses shall be 0.125" unless noted otherwise.
5) EMERGENCY LIGHTING (BATTERY BACKUP): Self-contained emergency lighting for LED light fixtures shall have a minimum of 10W output for 90 minutes, unless noted otherwise on drawings.

2-08 SWITCHGEAR

SAFETY SWITCHES AND FUSES

1) SWITCHES: NEMA Standard HD, heavy-duty type, 3 pole, 480 or 240 volt, as indicated, with Class R fuse clips. Manufactured by Square D, General Electric, Siemens, or Eaton.
2) FUSES: Time delay type, UL Class RK5. Bussman Fusetrons, or approved equal of ChaseShawmut or General Electric.
3) NAMEPLATE: Provide engraved nameplate for each safety switch identifying load served, voltage, and fed-from identification.

PANELBOARDS

1) MANUFACTURERS: New breakers to match existing.
2) CIRCUIT BREAKERS: Molded case bolt in type. Breakers shall be rated for the existing panelboard interrupting capacity rating in RMS symmetrical amperes. Two and three pole breakers shall have common internal trip.
3) CIRCUIT NUMBERING: Circuit numbering and breaker layout to match Contract Documents. Where circuit numbering is not permanently engraved, the manufacturer's plastic numbering strips shall be used. Paper numbers are not acceptable and may not be used.
4) NAMEPLATE: Provide engraved nameplate for each impacted panel identifying panel name, voltage, phase, and fed-from identification.

NAMEPLATES AND WARNING SIGNS

1) NAMEPLATE: Provide engraved 3-ply laminated plastic nameplates for each panelboard, safety switch, transformer, enclosed circuit breaker, contactor, and lighting control panel. Attach to equipment cover using metal screws, rivets, or industrial epoxy cement. Manufacturer's sticky-back adhesive is not acceptable. Use 1/4" white letters on black field for normal power items. Use 1/4" white letters on red field for emergency power items (generator).
2) METAL-BACKED, BUTYRATE WARNING SIGNS: Weather-resistant, nonfading, preprinted, celluloseacetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
3) FIRE WALL PENETRATION IDENTIFICATION: See 3-01.

PART 3 - EXECUTION

3-01 GENERAL REQUIREMENTS

WORKMANSHIP: All work shall be installed in a neat and orderly manner. Devices, cabinets, covers, fixtures, exposed raceways, etc., shall be aligned parallel or perpendicular to the building walls, ceiling, and floor. Wiring in panelboards and cabinets shall be neatly looped and laced, and not wadded. The Owner reserves the right to require repair or replacement of defective workmanship and material without additional compensation to the Contractor.

SUPPORTS: Conduits, boxes, cabinets, enclosures, lighting fixtures, etc., shall be securely supported by structural members or structural walls at intervals required by the NEC or as recommended by the manufacturer. Plaster, gypsum board, acoustical tile, and other ceiling and wall finish materials shall not be used for support.

Recessed light fixtures and recessed ceiling speakers shall be independently supported by two (2) or four (4) #12 steel hanger wires. Hanger wires shall be hung within 10 degrees of plumb, and shall be securely tied to structural members such as steel joists or beams, or to steel angles or tubing which bridge structural members. In addition to hanger wires, recessed light fixtures shall be securely fastened to the ceiling framing member per the requirements of NEC 410.36(B). All wiring located above fire rated assemblies must comply with the requirements of NEC 300.11(A)(1).

CUTTING, PATCHING, AND PAINTING: The Electrical Contractor shall perform all boring, drilling, and cutting of walls, ceilings, and floors as required to install and support his raceways and equipment. Provide rough patching to seal penetrations through walls, ceilings, and floors. Finish patching and painting will be performed by the General Contractor.

FIRE WALL PENETRATIONS: Penetrations through fire rated walls and floors shall be sealed to maintain the integrity of the fire rating. Raceways through penetrations shall be in metal raceways. Penetration openings shall be sealed after the installation of the raceway with UL listed fire retardant material in accordance with Section 078413 (where applicable). Through penetrations of conduits and cables of fire resistance rated walls must comply with Section 714.3.1 of the IBC. Through penetrations of fire resistance ceiling assemblies must comply with section 714.4.1.1 of the IBC. **Firestopping for this project to be performed by a single firestopping subcontractor, refer to Section 078413 – PENETRATION FIRESTOPPING.**

Fire Wall Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed.
Include the following information on labels:

1) The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2) Contractor's name, address, and phone number.
3) Designation of applicable testing and inspecting agency. 4) Date of installation.

5) Manufacturer's name. 6)
Installer's name.

Where cable trays and/or signal cables penetrate rated walls the Electrical Contractor shall furnish and install a UL Listed rated assembly, Specified Technology, Inc. (STI) EZ-Path Triple Cable Pathway System, or equivalent system by Legrand, Cooper, Metacaulk, 3M, or Hilti. See details on drawings.

ROOF PENETRATIONS: Do not penetrate roof or flashing unless permitted, in writing, by the Architect-Engineer.

TRENCHING AND BACKFILL: The Electrical Contractor shall perform all excavation, trenching, and backfilling necessary to install his work. Trenches shall be run after final grades are established, and shall be run at 24 inches minimum depth from finished grades. Contact all underground utilities (electric, telephone, cable TV, gas, water, sewer) and establish locations of underground utilities prior to digging. Damages to underground utilities will be repaired by the Owner of the line, and the Contractor responsible for such damage will pay all costs of repairs. After completion of backfilling operations, restore the disturbed areas to their original condition by leveling, raking, seeding and mulching.

3-02 GROUNDING

CODE: Entire system shall be grounded and bonded in accordance with the requirements of Article 250 of the National Electrical Code. Comply with UL 467 for grounding and bonding materials and equipment. Comply with IEEE C2 grounding requirements.

GROUNDING CONDUCTORS: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

FEEDERS AND BRANCH CIRCUITS: Each feeder raceway shall be bonded to every cabinet, pull box, etc., to which it is connected by grounding bushings and bonding jumpers sized per NEC Table 250.122. Each branch circuit raceway must be connected to every cabinet, pull box, outlet box, etc., with double locknuts. Separate grounding conductors shall be installed on all feeders and on all lighting, receptacle and equipment branch circuits, whether indicated on the drawings or not. Size per NEC 250.122.

RECEPTACLES AND FIXTURES: Bond grounding terminal of each receptacle and fluorescent fixture to its outlet box with No. 12 green ground wire. Self-grounding receptacles are not acceptable as a substitute for this requirement.

3-03 RACEWAYS

WIRING: All wiring shall be installed in raceways, unless noted. Raceways shall be run concealed, unless noted.

BRANCH CIRCUITS:

1) Branch circuits shall be run concealed where practical.
2) Branch circuits run concealed in walls or ceilings shall be run in EMT, GRC, or IMC, except that Type MC Cable and Type MC-PCS Cable may be used for lighting branch circuits as indicated in 3.04 below.
3) Branch circuits run exposed to weather (wet or damp location) on exterior walls, canopies, ceilings, or on roofs shall be run in GRC or IMC with screwed fittings.
4) Branch circuits run exposed in dry, finished spaces shall be run in Wiremold surface metal raceway.
5) Branch circuits run exposed in interior damp locations, unfinished spaces (attics), and unoccupied spaces (storage room, equipment rooms, janitor's closet) may be run in EMT in lieu of Wiremold.
6) Branch circuits run underground shall be run in GRC, IMC, or Schedule 40 PVC plastic conduit.
7) All interior conduit homeruns to panelboards shall be run overhead in EMT, GRC, or IMC unless noted otherwise on the drawings.
8) Underground conduits shall be run 24" minimum below grade.
9) Metal conduits installed in contact with earth shall be painted with 2 coats Rustoleum paint or other acceptable preservative.
10) Where plastic conduits are indicated, transition from plastic to GRC or IMC below grade or slab and rise with GRC or IMC. PVC is not permitted above grade. EXCEPTIONS: 1) Plastic conduit may enter floor mounted switchboards, motor control centers, or other floor mounted enclosures. 2) Plastic conduit risers are acceptable where run concealed from underfloor conduit to receptacle or switch boxes in masonry walls.

COMMUNICATIONS CONDUIT:

1) All conduit for Communications Systems within the building shall be run above grade in walls and above ceiling in metal raceways. Conduit shall be run concealed in all areas not designated as a utility or electrical room, except surface mounted raceway may be used where devices are installed on existing walls. Communications conduit wiring may not be run underground or in slab unless specifically noted otherwise on the drawings.
2) Service-Entrance communications conduit and communications conduit run underground between buildings shall be run in Schedule 40 PVC encased in concrete with 2-inches minimum concrete encasement on all sides (Schedule 40 PVC is not required to be encased in conduit where run under the concrete floor slab). PVC is not permitted above grade.

FIRE ALARM SYSTEM CONDUIT:

1) All Fire Alarm System wiring within the building shall be run above grade in walls and above ceiling in metal raceways. Raceways shall be run concealed in all areas not designated as a utility or electrical room, except surface mounted raceway may be used where devices are installed on existing walls. Fire alarm wiring may not be run underground or in slab unless specifically noted otherwise on the drawings.
2) Conduit within the building used for Fire Alarm System wiring shall be red, similar to Allied Fire Alarm EMT, except where noted otherwise on the drawings. EXCEPTION: Fire Alarm System raceway run exposed in finished spaces shall be Wiremold V700 or equivalent.
3) Fire Alarm System wiring run underground between buildings shall be run in Schedule 40 PVC encased in concrete with 2-inches minimum concrete encasement on all sides (Schedule 40 PVC is not required to be encased in conduit where run under the concrete floor slab). PVC is not permitted above grade.

FLEXIBLE CONDUITS: Recessed light fixtures located in accessible ceilings may be connected to an outlet box above the ceiling thru flexible conduit “whips”. Run a separate ground wire in all conduit, including flexible fixture whips. DO NOT loop flexible conduit from one fixture to another. Manufacturer-supplied Metal-clad cable fixture whips (#18 AWG) shall be permitted for light fixture whips provided they include a ground wire and do not exceed 6’ in length.

Final connections to motors, motor driven equipment, transformers, and vibrating equipment shall be made thru flexible conduit, 36" maximum length. "Sealtite" flexible metal conduit shall be installed outdoors, in equipment rooms, and in wet locations.

PULL WIRES: Raceways for wiring by others or for future shall contain a No. 14 galvanized steel pull wire or equivalent plastic cord with 200 lb. tensile strength.

INSTALLATION: Ream raceways, butt ends into couplings, 3 quarter bends per run maximum, plug raceways until wiring is pulled in place. Exposed conduits shall be run parallel and perpendicular to walls, floor, and ceiling. Multiple conduit runs shall be racked using Unistrut or Kindorf channels and pipe clamps. Install conduits in concrete slabs between the top and bottom layers of reinforcing steel. Maximum size of conduits in slabs is 1 inch. Crossing of conduits in slabs shall be avoided, if possible.

PULL BOXES: Maximum length between pull points shall be 200 ft. for pulls with two 90 degree bends, and 100 ft for pulls with three 90 degree bends. Furnish and install pullboxes, junction boxes, handholes, or conduit bodies where bends or pulling lengths exceed these specifications.

EXPANSION JOINTS: Furnish and install expansion joints where conduit crosses building expansion joints and for straight runs exceeding 100 ft. in length.

PLASTIC CONDUIT: Do not damage conduit while making field bends and offsets, cutting and joining conduit. Use GRC elbows where length between pulls exceeds 100 ft. Clean conduit prior to applying solvent. Ensure that conduit extends fully into coupling or fitting when making joints.

MINIMUM SIZE: Home runs to panelboards shall be 3/4" minimum, otherwise raceways shall be 1/2" minimum, except that flexible conduit shall be 3/8" minimum.

FIRESTOPPING: Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

TEST AND INSPECTIONS: After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3-04 WIRE AND CABLE

MINIMUM SIZE: No. 12 for power circuits, No. 16 for control circuits, unless noted. Where home run exceeds 75 ft. length on 120 volt circuits, use No. 10 minimum.

COLOR CODE: No. 12 and No. 10 shall have color-coded insulation. No. 8 and larger shall be marked at all terminals and joints with color-coded tape. Color code as follows:

Voltage	Phase A	Phase B	Phase C	Neutral	Grounding
240/120	Black	Orange	Blue	White	Green
208/120	Black	Red	Blue	White	Green
480/277	Brown	Orange	Yellow	Gray	Green

INSTALLATION: Ensure that raceway system is complete and that conductors will be free from moisture or physical damage prior to installing conductors. Install all conductors at the same time. Do not exceed cable manufacturer's recommended pulling tension for conductors. Where required, lubricate cables with Ideal Yellow 77, Burndy Slikon, or other acceptable cable lubricant. Do not use lubricants that are not acceptable to the Architect-Engineer.

SPLICING: Splices on Sizes No. 10 and smaller shall be made with wire nuts. Splices on Sizes No. 8 and larger shall be made with split bolt connectors, compression connectors, or solderless lugs. Splices shall be insulated with two or more layers of Scotch 23 rubber tape covered with two or more layers of Scotch 33 plastic tape, or acceptable equivalent method.

CONNECTIONS: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Absent published values, use those specified in IL 486A and UL 486B.

MULTIWIRE BRANCH CIRCUITS: Shared or common neutrals are not permitted on this project for multiwire branch circuits. The Contractor shall pull a separate neutral for all 120V & 277V circuits.

0-10V DIMMING: Where 0-10V wiring is installed using Class 2 wiring methods it shall not be run in the same raceway as any line voltage or Class 1 circuits. Where 0-10V wiring is run in the same raceway as line voltage or Class 1 circuits it shall be reclassified and installed as Class 1 circuits per NEC 725.130(A), and the Class 2 markings shall be eliminated and the entire circuit installed using the wiring methods and materials in accordance with Part II, Class 1 Circuits of NEC 725.

TYPE MC / Type MC-PCS CABLE: Type MC / Type MC-PCS cable may be used for interior, concealed lighting branch circuits located above accessible lay-in ceilings and receptacle branch circuits located in stud walls or above accessible lay-in ceilings, except that homeruns to panelboards shall be in EMT. Type MC / Type MC-PCS Cable may not penetrate rated walls or floors and may not be used underground or under slab. Type MC / Type MC-PCS Cable shall be supported in accordance with the requirements of NEC 330.30.

3-05 BOXES

WALL OUTLETS: Flush mounted, unless noted. Boxes shall be securely mounted to wall studs or be grouted in masonry. Boxes shall have single or multi-gang plaster rings, as required. "Throughwall" boxes SHALL NOT BE USED. Back-to-back mounting of boxes is not permitted. Boxes on opposite sides of a rated wall shall have a minimum of 24" horizontal spacing or shall be protected with listed putty pads. Locate boxes so that cover or plate will not span different building finishes.

RECESSED BOXES IN MASONRY WALLS: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

RECESSED BOXES IN STUD WALLS: Support boxes from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

CEILING OUTLETS: Flush mounted or concealed above ceiling. Boxes for fixture support shall have studs or ears as required and shall be securely supported by adjustable bar hangers or steel angle.

JUNCTION BOXES, PULL BOXES, AND WIREWAYS: Shall be sized and installed as indicated on the drawings or where required by NEC for pulling or splicing wiring. All junction boxes and pull boxes shall be accessible. Junction boxes and pull boxes shall not be located above inaccessible ceilings.

HANDHOLES: See details on drawings.

LOCATIONS: Verify door swings and mount switches on strike side, 6" from jamb. Verify counter heights and arrangement prior to setting boxes. The Owner reserves the right to move any outlet by as much as 10 ft. from its indicated location at no additional cost, provided the Contractor is notified prior to roughing in.

3-06 WIRING DEVICES

INSTALLATION: Devices shall be installed as indicated on the drawings and wired in accordance with the manufacturer's instructions. Install conductors at each outlet with at least 6-inches of slack.

MASKING: Devices shall be masked to prevent painting of faces and handles during construction. Do not install cover plates until clean-up has been completed.

COVER PLATES: Cover plates shall be installed on all wiring devices, telephone/data outlets, junction boxes, and outlet connections. Install blank stainless steel cover plates for any unused telephone/data outlets.

3-07 LIGHTING AND LIGHTING CONTROLS

INTERIOR LIGHTING

1) LOCATION: Install fixtures symmetrically on ceiling or ceiling grid as indicated on the drawings and as directed on the job.
2) MOUNTING: Support all fixtures securely from structural or framing members with adjustable bars, metal angles, threaded rods or other acceptable methods - Installation shall comply with NEC 314.27. Support recessed fixtures as specified in paragraph 3-01 - Installation shall comply with NEC 410.36(B).
3) SUSPENDED LIGHTS (FINISHED CEILINGS): Suspended linear direct/indirect fixtures in classrooms, offices, conference rooms, and other finished interior spaces shall be suspended using aircraft cable as indicated on the drawings, unless noted otherwise.
4) SUSPENDED LIGHTS (EXPOSED CEILINGS): Suspended industrial fixtures, high-bay fixtures, low-bay fixtures, etc. located in gymnasiums, warehouses, industrial facilities, and other larger spaces with exposed ceilings shall be suspended using threaded rods and the Electrical Contractor shall furnish and install unistrut or other structural member as required to support fixtures. Mount so bottom of fixture is as close to bottom of beam or truss as possible, unless noted otherwise.

3-08 SWITCHGEAR

SAFETY SWITCHES: Mount switches where shown on drawings and within sight of equipment served. Mount in a readily accessible location unless noted. Verify fuse sizes with equipment manufacturer's requirements.

PANELBOARDS: Provide typewritten circuit directory for each impacted panel identifying load served and room location. Identify spares in pencil. Panelboard schedules must comply with NEC 408.4, including listing room description and room number for each load. Turn all spare breakers off.

NAMEPLATES AND WARNING SIGNS: Verify identity of each item before installing identification products. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

ARC-FLASH HAZARD WARNING LABELS: Provide warning labels for all panels, switchboards, switchgear, and industrial control panels per the requirements of NEC 110.16. Labels to read,

DANGER ARC FLASH & SHOCK HAZARD APPROPRIATE PERSONAL PROTECTION EQUIPMENT REQUIRED

3-09 COMPLETION OF WORK

TESTS AND FINAL REVIEW: Upon completion of work, the entire system shall be completely operational and tested to conform with these specifications and drawings, and shall be reviewed by the Architect-Engineer. All defects in workmanship and material shall be immediately corrected without additional compensation to the Contractor.

The final review of the electrical installation by the Engineer cannot be provided until the following items have been submitted to the Engineer for review:

1) Letter from the Electrical Contractor on company letterhead indicating that the installation is complete and ready for a final review.

Failure to submit the above documentation prior to requesting the Engineer's Final Review of the project may result in delays in providing the final review. The Engineer assumes no liability for delays in the project resulting from failure to provide the proper documentation.

The system will not be considered complete until Record Documents are provided and training of facility personnel on the system operation is complete. This facet of the services to be provided by the Contractor is deemed very important to the satisfactory completion of the contract and the installation cannot be deemed complete until these services have been provided in accordance with the Contract Documents.

CLEAN UP: Upon completion of all installations and prior to final acceptance by the Owner, remove all debris from the site. Clean and touch up paint on fixture lenses and trims, cabinets, enclosures, cover plates, etc.

END OF SECTION 260500

PART 1 - GENERAL REQUIREMENTS

1-01 SUMMARY

Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1-02 ELECTRICAL SUBMITTALS

Electrical shop drawings shall be submitted in one complete package containing all items required by this specification and all other Division 26-28 specifications. Partial shop drawing submittals may be rejected by the Architect-Engineer.

Exceptions: Fire Alarm System CAD drawings, Lighting Control System CAD drawings, and Allowanced Light Fixtures may be submitted separately if additional time is needed to prepare these shop drawings. Submit written request to Architect/Engineer for extension with a timeline schedule indicating submittal date for items to be submitted separately.

Electrical shop drawings shall be transmitted to the Architect, to the Engineer of Record, and to Vicki Sweat (vicki@simsgroupusa.com). Where Construction Management software such as Procore or Submittal Exchange is used, then Engineer of Record for Sims Group and Vicki Sweat shall be added as users for electrical submittals.

1-03 ELECTRICAL SUBMITTAL FORMAT

FILE TYPE: Electrical submittals to be submitted digitally and shall be searchable pdf documents divided into categories as indicated below.

SUBMITTAL TRANSMITTAL LETTER: The submittal package shall include a single transmittal letter saved as a separate pdf file indicating the following:

- The project name and address
- The date of submission
- The Electrical Contractor name and address
- The General Contractor name and address
- The Construction Manager name and address (if applicable)
- A list of each submittals category (use categories listed below)
- Any applicable remarks and/or comments
- Signature of transmitter

SUBMITTAL CATEGORY COVER SHEET: The digital submittal shall be divided into submittal categories as indicated below. **Each submittal category shall be saved as a separate pdf file with a cover sheet indicating the following:**

- The project name
- The submittal category (category names to match those listed below where applicable)
- The date of submission
- The Electrical Contractor name and address

✦ The name and address of the firm or entity that prepared the submittal. ✦ Any applicable remarks and/or comments

Submittals not meeting the above criteria may be rejected.

Refer to the sample Category Cover Sheet at the end of this specification section.

ELECTRICAL SUBMITTAL CATEGORIES: Within 45 days after award of contract and before any materials are delivered to the site, submit a digital set of Electrical Submittals in pdf format to the Architect-Engineer on each of the following categories/materials:

1) Section 260500, 2-03: Raceways and Fittings.
2) Section 260500, 2-04: Wire and Cable.
3) Section 260500, 2-05: Boxes and Wireways. 4) Section 260500, 2-06: Wiring Devices.
5) Section 260500, 2-07: Lighting Fixtures
6) Section 260500, 2-08: Switchgear (Disconnect Switches, Circuit Breakers).
7) Section 260529: Hangers and Supports for Electrical Systems (Including Engineer's calculations where required).

OPTIONAL FEATURES: Clearly identify options requiring selection by Architect/Engineer.

RESUBMITTALS: Make resubmittals in same format as initial submittal. Note date and content of previous submittal. Note date and content of revision in label or title block and clearly indicate extent of revision.

DISTRIBUTION: Furnish copies of final reviewed submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms where applicable.

USE FOR CONSTRUCTION: Retain complete copies of submittals on Project site (either a digital copy or a hard copy is acceptable provided it is readily accessible). Use only final action submittals that are marked as such from the Engineer's action stamp.

1-04 ELECTRICAL SUBMITTAL SCHEDULE

SCHEDULE: Within 45 days after award of contract and before any materials are delivered to the site, submit a digital set of Electrical Submittals in pdf format to the Architect-Engineer. If additional time is needed, submit a written request to Architect/Engineer for extension with a timeline schedule indicating revised submittal date.

No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

No extension of the Contract Time will be authorized because of failure to transmit submittals in the proper format.

1-06 ELECTRICAL SUBMITTAL REJECTION

50 ELECTRICAL SUBMITTALS

Failure to comply with the above criteria may result in rejection of the submittal by the Architect-Engineer. Refer to Division 1 for additional Submittal requirements.

PART 2 - NOT APPLICABLE

PART 3 - EXECUTION

3-01 CONTRACTOR'S ACTIONS

GENERAL: The primary purpose of submitting electrical shop drawings is to demonstrate the way by which the Contractor proposes to comply with the design concept expressed in the Contract Documents for the portions of work that require submittals.

CONTRACTOR REVIEW: Prior to submittal to the Engineer, the Contractor shall review shop drawings for compliance with the Contract Documents.

No electrical equipment or materials shall be ordered or installed by the Contractor prior to receipt of properly reviewed shop drawings. The Contractor may not perform any portion of the work for which the Contract Documents require submittal and review of shop drawings prior to receipt of properly reviewed shop drawings.

Failure to comply with the above criteria may require the removal by the Contractor of any equipment or materials installed prior to receipt of properly reviewed electrical shop drawings, at no cost to the Owner or the Architect/Engineer.

3-02 ENGINEER'S ACTIONS

GENERAL: Engineer will not review submittals that do not bear Contractor's approval/acceptance stamp and will return them without action.

ELECTRICAL SUBMITTALS: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate actions required.

INCOMPLETE OR PARTIAL SUBMITTALS: Incomplete or partial submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 260510

50 ELECTRICAL SUBMITTALS

ELECTRICAL SUBMITTAL CATEGORY COVER SHEET

PROJECT NAME: Sample Project Middle School

SUBMITTAL CATEGORY: Section 260500, 2-06 Wiring Devices

DATE OF SUBMISSION: May 01, 2023

ELECTRICAL CONTRACTOR: ABCD Electrical Contractor, 123 Main Street, Anywhere, SC 29999

SUBMITTAL PREPARER: WXYZ Lighting, Inc. 456 Elm Street Somewhere, SC 21111

REMARKS/COMMENTS: Color selection needed for wiring devices.

PART 1 - GENERAL REQUIREMENTS

1-01 SUMMARY

SECTION INCLUDES:

1) Hangers and supports for electrical equipment and systems. 2) Construction requirements for concrete bases.

1-02 PERFORMANCE REQUIREMENTS

1) Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
2) Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
3) Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
4) Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1-03 SUBMITTALS

1) Product Data: For steel slotted support systems.
2) Shop Drawings: Shop Drawings shall show fabrication and installation details and include calculations for the following:

    a. Trapeze hangers. Include Product Data for components.
    b. Steel slotted channel systems. Include Product Data for components.
    c. Equipment supports.

3) Welding Certificates.

1-04 QUALITY ASSURANCE

1) Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel." 2) Comply with NFPA 70.

PART 2 - PRODUCTS

2-01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

1) Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

    a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

i. Allied Tube & Conduit.

ii. Cooper B-Line, Inc.; a division of Cooper Industries. iii. ERICO International Corporation. iv. GS Metals Corp.

v. Thomas & Betts Corporation. vi. Unistrut; Tyco International, Ltd.

vii. Wesanco, Inc.

c. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

d. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

e. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

f. Channel Dimensions: Selected for applicable load criteria.

2) Raceway and Cable Supports: As described in NECA 1 and NECA 101.

3) Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

4) Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

5) Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

6) Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

a. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

i. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

ii. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- Hilti Inc.
- ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
- MKT Fastening, LLC.
- Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

b. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

i. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

ii. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- Cooper B-Line, Inc.; a division of Cooper Industries.
- Empire Tool and Manufacturing Co., Inc.
- Hilti Inc.
- ITW Ramset/Red Head; a division of Illinois Tool Works, Inc. - MKT Fastening, LLC.

c. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

d. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

e. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
f. Toggle Bolts: All-steel springhead type.
g. Hanger Rods: Threaded steel.

2-02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

1) Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
2) Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3-01 APPLICATION

1) Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
2) Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
3) Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   a. Secure raceways and cables to these supports with two-bolt conduit clamps.
4) Spring-steel clamps designed for supporting single conduits without bolts may be used for 11/2inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3-02 SUPPORT INSTALLATION

1) Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
2) Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
3) Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
4) Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

   a. To Wood: Fasten with lag screws or through bolts.
   b. To New Concrete: Bolt to concrete inserts.
   c. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
   d. To Existing Concrete: Expansion anchor fasteners.
   e. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm)

thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

f. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts; beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69; or spring-tension clamps.
g. To Light Steel: Sheet metal screws.
h. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

5) Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3-03 INSTALLATION OF FABRICATED METAL SUPPORTS

1) Comply with installation requirements in Division 05 Section "Metal Fabrications" for sitefabricated metal supports.
2) Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
3) Field Welding: Comply with AWS D1.1/D1.1M.

3-04 CONCRETE BASES

1) Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
2) Use 3000-psi, 28-day compressive-strength concrete.
3) Anchor equipment to concrete base.
   a. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   b. Install anchor bolts to elevations required for proper attachment to supported equipment.
   c. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3-05 PAINTING

1) Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
2) Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
3) Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 31 1000 - SITE CLEARING AND DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Protection of existing trees and vegetation to remain.

B. Removal of surface debris.

C. Grubbing.

D. Removal of sod and grassing.

E. Removal of indicated pavements and other above-grade improvements.

F. Removal of indicated below-grade improvements.

1.3 RELATED SECTIONS

A. Section 02 2100 – Subsurface Investigation.

B. Section 31 2000 – Earth Moving.

C. Section 31 2333 – Trenching and Backfill for Site Utilities.

D. Section 31 2500 – Sedimentation and Erosion Control.

E. Section 32 9200 – Lawns and Grassing.

1.4 MATERIALS OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings according to Division 1 Specification Sections.
1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions which will remain.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Specification Sections.

B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts that are completely familiar with the specified requirements and methods needed for the proper performance of the Work of this Section.

C. Use equipment adequate in size, capacity and numbers to accomplish the Work in a timely manner.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable regulations relating to environmental requirements, disposal of debris, burning debris on-site, use of herbicides, and SCDHEC requirements for sedimentation and erosion control.

B. Coordinate clearing work with utility companies.

1.8 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. DO NOT BEGIN TRENCH/PIT EXCAVATION BEFORE CALLING ‘PALMETTO UTILITY PROTECTION SERVICE’ AT 1-800-922-0983. Call 72-hours before any planned excavation activities. Utilities within Public Properties or Easements will be located by P.U.P.S. Failure to notify P.U.P.S. will result in the Contractor being liable for any repairs to utilities that are damaged.
2. Protect existing improvements and utilities on adjoining properties and on the Owner’s property.
3. Restore damaged improvements or utilities to their original conditions, as acceptable to the property owner.

C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning or roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within the drip line, excess foot or vehicular traffic, or parking of vehicles with the drip line or any acts which may be harmful to the continued growth of the trees to be protected. Provide temporary guards to protect trees and vegetation to be left standing. For the purposes of tree protection, the drip line is defined as 1-1/2 times the diameter of the tree measured 4-feet above existing grade.

1. Water trees and other vegetation to remain within the limits of contract work as required to maintain their health during the course of construction operations.
2. Provide protection for roots over 1-1/2 inches in diameter that are cut during construction operations. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible or cut off cleanly below grade.
3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner acceptable to the Architect/Engineer. Employ a licensed arborist to repair damages to trees and shrubs. All tree work shall be done in accordance with the most recent revision of the International Society of Arboriculture practices.
4. Replace trees that cannot be repaired and restore to full-growth status, as determined by arborist.

    a. If a tree identified to remain is damaged, remove tree and replace with a tree of the same or similar species, 2-inch caliper or larger, from balled and burlapped nursery stock when construction activities in the vicinity are completed.

D. Install tree protection barrier where indicated on the plans using metal tee for posts and orange construction fence, spacing posts no less than 8-feet on center. Height to be a minimum of 3feet above grade.

    1. Place tree protection fencing in a manner to prevent the approach of equipment within the drip line of trees to remain.

E. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner's property will be obtained by Owner before award of Contract.

F. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

G. Notify utility locator service for area where Project is located before site clearing.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 31 20 00 – Earth Moving.

    1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

2.2 ACCESSORIES

A. Herbicide: Contractor’s choice of legal and appropriate chemical formulation for selective weed control for the specific season of year as approved by applicable regulatory agency.

B. Tree Wound Paint: Bituminous based paint of standard manufacture specifically formulated for tree wounds.

PART 3 - EXECUTION

3.1 PREPARATION

A. Locate and identify utilities to remain.

B. Protect and maintain benchmarks and survey control points from disturbance during construction.

C. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways. D. Locate and clearly flag trees and vegetation to remain.

E. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner. F.

Identify a temporary storage area for placing removed materials.

3.2 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect/Engineer not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect/Engineer's written permission.

3.3 CLEARING AND GRUBBING

A. Remove obstructions, grass, and other vegetation as indicated and to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Completely remove surface rock, stumps, roots, obstructions, and debris extending to a depth of 18-inches below exposed subgrade.

   a. Remove roots 1-1/2 inches or smaller.
   b. Clear undergrowth and deadwood without disturbing topsoil.

   c. Apply herbicide to remaining stumps to inhibit growth.

4. Use only hand methods for grubbing within drip line of remaining trees.
5. Remove existing sod and grassing without disturbing topsoil.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding 6-inch loose depth, and compact each layer to a density equal to adjacent original ground. C. Selective Clearing:

1. Shall be performed in areas designated by Architect/Engineer.
2. Selective clearing shall consist of remove all vegetation, brush, stumps, etc. within the designated area. Grubbing will not be required within these areas. Grub areas, as directed, using by-hand methods only.
3. Selected trees shall be left standing and care shall be taken not to damage remaining trees.

D. Tree Pruning: Where existing trees are to remain, and branches encroach with the areas of new construction, prune individual trees as necessary.

1. Trim trees designated to remain of dead branches of 1-1/2 inches in diameter or greater.
2. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branch.
3. Paint cuts greater than 1-1/4 inches in diameter with approved tree wound paint.

3.4 TOPSOIL STRIPPING

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2-inches in diameter; and free of weeds, roots, and other deleterious materials.

B. See Section 31 20 00 – Earth Moving for Topsoil Removal and Storage.

3.5 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove portions of slabs, pavements, curbs, gutters, aggregate bases, and other above-grade improvements as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.6 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property. B. Burning on Owner’s Property: Burning is NOT permitted on the Owner’s Property.

END OF SECTION 03 1000

SECTION 31 2000 – EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Sub-base course for concrete walks and pavements.
5. Sub-base course and base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the sub-base course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation. G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Sub-base Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below sub-base, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 PROJECT CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

B. Do not commence earth moving operations until tree & plant protection measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Sub-base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material, 4 inches (100 mm) deeper elsewhere, to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to lines, cross sections, elevations, and sub grades as indicated. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

D. Place and compact final backfill of satisfactory soil to final subgrade elevation.

E. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 100 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at [85] <Insert number> percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus 1 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place sub-base course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared sub grade, place sub-base course and base course under pavements and walks as follows:

1. Shape sub-base course and base course to required crown elevations and cross-slope grades.

2. Place sub-base course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
3. Compact sub-base course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 2000

SECTION 31 2319 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes construction dewatering.

1.2 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

1.3 SUBMITTALS

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, discharge lines, piezometers, and flow-measuring devices; and means of discharge, control of sediment, and disposal of water.

B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction. B. Pre-installation Conference: Conduct conference at project site.

1.5 PROJECT CONDITIONS

A. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

3.1 INSTALLATION

A. Provide temporary grading to facilitate dewatering and control of surface water.

B. Monitor dewatering systems continuously.

C. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 31 Section "Earth Moving" during dewatering operations.

D. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

1. Space well points or wells at intervals required to provide sufficient dewatering.
2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

E. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

F. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

G. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 36 inches (900 mm) below surface of excavation.

H. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

END OF SECTION 31 2319

SECTION 31 2333 – TRENCHING AND BACKFILLING FOR SITE UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Excavating trenches, backfilling and compacting for utilities, 5-feet outside the building, from site utility connections to Utility Main connections.

B. Compacted bedding under fill over utilities to subgrade elevations.

1.3 RELATED SECTIONS

A. Section 02 2100 – Subsurface Investigation.

B. Section 31 2000 – Earth Moving.

C. Section 31 2500 –Sedimentation and Erosion Control.

D. Section 33 1100 – Water Distribution System.

E. Section 33 3000 – Sanitary Sewer System.

F. Section 33 4000 – Storm Drainage System.

G. Section 32 9200 – Lawns and Grassing.

1.4 REFERENCES

A. AASHTO T180 – Standard Specification for Moisture-Density Relations of Soils using a 10-lb. Rammer and an 18-inch drop; American Association of State Highway and Transportation Officials; 1997.

B. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Course Aggregates; 1996a.

C. ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort {12,400 ft-lbs/cf}; 1991 (Re-Approved 1998).

D. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in-place by the SandCone Method; 1990 (Re-Approved 1996).

E. ASTM D1557 – Test Method for Laboratory Compaction Characteristics of Soil using Modified Effort {56,000 ft-lbs/cf)}; 1991 (Re-Approved 1998).

F. ASTM D2167 – Standard Test Method for Density and Unit Weight of Soil in-place by the Rubber Balloon Method; 1994.

G. ASTM D2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System); 1998.

H. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in-place by Nuclear Methods (Shallow Depth); 1996.

I. ASTM D3017 – Standard Test Method for Water Content of Soil and Rock in-place by Nuclear Methods (Shallow Depth); 1996.

J. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 1998.

K. SCDOT – Standard Specifications for Highway Construction, South Carolina Department of Transportation; 2000 Edition.

1.5 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

D. Excavation: Removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

E. Unauthorized Excavations: Removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect/Engineer. Unauthorized excavation, as well as remedial work directed by Architect/Engineer, shall be at the Contractor's expense.

1. Under footings, foundation bases, or retaining walls, correct unauthorized excavations by extending indicated bottom elevation of footing or base to excavated bottom, without altering the required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to the Architect/Engineer.
2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations for same classification, unless otherwise directed by the Architect/Engineer.

F. Additional Excavations: Removal of materials beyond indicated subgrade elevations as directed by the Architect/Engineer. When excavation has reached required subgrade elevations, notify the Architect/Engineer and Testing Agency, who will make an inspection of conditions. If the Architect/Engineer and Testing Agency determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated materials as directed by the Architect/Engineer. The Contract Sum may be adjusted by an appropriate Contract Modification.

1. Remove of unsuitable material and its replacement, as directed, will be paid on basis of Conditions of Contract relative to changes in Work. Notify the Architect/Engineer prior to removal of any unsuitable materials.

G. Rock Excavation: Removal of any hard, natural substances that requires the use of explosives and/or special impact tools such as jackhammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavation machinery. To be considered rock, the substance shall be of continuous material; individual boulders or rocks in soil will not be considered to be rock excavation.

H. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material exceeding 1-c.y. for bulk excavation or 3/4-c.y. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, short-tip-radius rock bucket; rated at not less than 120-hp flywheel power with bucket-curling force of not less than 25,000 lbs. and stickcrowd force of not less than 18,700 lbs.; measured according to SAE J-1179.
2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 45,000-lbs. breakout force; measured according to SAE J-732.

I. Muck: Materials unsuitable of carrying loads due to high organic content or saturation to the extent that the material is somewhat fluid and must be removed by dragline, dredge or other special equipment.

J. Bulk Excavation: Excavations more than 10-feet in width and pits more than 30-feet in either length or width.

K. Fill: Soil materials used to raise existing grades to subgrade elevations indicated.

L. Finish Grade Elevations: Elevations indicated on the Drawings.

M. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

N. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

O. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2-inches in diameter; and free of weeds, roots, and other deleterious materials.

P. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.6 SUBMITTALS

A. Product Data: For the following:

1. Each type of plastic warning tape.
2. Drainage fabric.
3. Separation fabric.

B. Materials Sources: Submit name of imported material source.

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1. Classification according to ASTM D2487 of each on-site or borrow soil material proposed for fill and backfill.
2. Laboratory compaction curves according to ASTM D698 for each on-site or borrow soil material proposed for fill and backfill.
3. Laboratory compaction curves according to ASTM D1557 for each on-site or borrow soil material proposed for fill and backfill.

D. Project Record Documents: Accurately record actual locations and make as as-built drawing of all utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Perform Work in accordance with State of South Carolina Highway Department Standard Specifications.

1. Maintain one copy on site.

C. All work shall be performed in strict accordance with this specification and in accordance with the subsurface investigation referenced in Section 02 2100. The strictest requirements shall apply if discrepancies occur.

D. Provide sufficient quantities of fill to meet the project schedule and requirements. When necessary, store materials on-site in advance of need.

E. When fill materials need to be stored on-site, locate stockpiles where designated.

1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
2. Prevent contamination.
3. Protect stockpiles from erosion and deterioration of materials.

F. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

G. Geotechnical Testing and Inspection Service: The Owner will employ and pay for a qualified independent Geotechnical Testing Agency to perform soil testing and inspection services during earthwork operations. The Contractor shall schedule his work in such a manner to permit a reasonable amount of time for testing to be performed before placing succeeding lifts of fill material and shall keep the Testing Agency informed of all progress.

1. The Owner shall pay for the cost of initial testing, subsequent tests, which are required as a result of a test failure, shall be paid for by the Contractor.

H. Pre-Excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Specification Sections.

1.8 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. DO NOT BEGIN ANY TRENCH/PIT EXCAVATION BEFORE CALLING 'PALMETTO UTILITY PROTECTION SERVICE' AT 1-800-922-0983. Call 72-Hours before any planned excavation activities. Utilities within Public Properties and Easements will be located by P.U.P.S. Failure to notify P.U.P.S. will result in the Contractor being liable for any repairs to utilities which are damaged.
2. In the event uncharted, or incorrectly charted, piping or other utilities are encountered during excavation, consult utility owner immediately for directions. Cooperate with the Owner and utility companies in keeping respective services in operations. Repair damaged utilities to the satisfaction of the utility owner.
3. Do not interrupt existing utilities serving facilities occupied by the Owner or others, during occupied hours, except when permitted in writing by the Architect/Engineer and then only after acceptable temporary utilities have been provided.
4. Provide a minimum of 48-hours notice to the Architect/Engineer, and receive written notice to proceed before interrupting any utility.

B. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
3. Perform excavation by hand within drip line of large trees to remain. Protect root systems from damage or dry-out to the greatest extent possible. Maintain moist conditions for root system and cover exposed roots with moistened burlap.

C. Dust Control: Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors, and to others working on or near the site.

D. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

E. Protect benchmarks, survey control points, existing structures, fences, sidewalks, pavements, curbs, gutters, and other structures from excavation equipment and vehicular traffic.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Soil materials used as fill, backfill, and subgrades for structures shall consist of suitable materials as found available on site until such supply of on-site material is depleted.

1. Provide suitable materials free of organic matter and deleterious substances, containing no rocks or lumps over 2-inches in the largest dimension, and with not more than 15% of rocks or lumps larger than 1-inches in the greatest dimension.
2. Do not permit rocks having a dimension greater than 1/2-inch in the upper 6-inches of fill or backfill.

B. In the event that the quantity of suitable on-site materials is insufficient to complete the Work, suitable borrow materials, as approved by the Architect/Engineer, shall be provided by the Contractor at no additional expense to the Owner.

C. Satisfactory Soils: ASTM D2487 soil classification groups CL, GW, GP, GM, ML, SC, SM, and SW, or a combination of these group symbols; Graded, free of debris, waste, frozen materials, vegetation, and other deleterious matter.

D. Unsatisfactory Soils: ASTM D2487 soil classification groups CH, GC, ML, MH, SP, OL, OH, and PT, or a combination of these group symbols. All highly organic soils will be considered unsuitable.

1. Excess water in soil materials will cause soil to be determined unsuitable regardless of normal classification. Unsatisfactory soils also include satisfactory soils not maintained within 2-percent of optimum moisture content at time of compaction.
2. The acceptability of composite sand-clay, sand-silt, and silt-clay soils will be determined by the Soils Engineer.

E. Subsoil Materials: Excavated material graded free of lumps larger than 6-inches and rocks larger than 3-inches and debris.

F. Sub-base: See Section 32 1000 – Aggregate Base Course.

G. Base: See Section 32 1000 – Aggregate Base Course.

H. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90-percent passing a 1-1/2-inch sieve and not more than 12-percent passing a No. 200 sieve.

I. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100-percent passing a 1-inch sieve and not more than 8-percent passing a No. 200 sieve.

J. Drainage Fill: See Section 32 1000 – Aggregate Base Course.

K. Filter Material: See Section 32 1000 – Aggregate Base Course.

L. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6-inches wide and 4-mils thick, continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6-inches wide and 4mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30-inches deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.

4. Blue: Water systems.
5. Green: Sanitary and Storm Sewer systems.

C. Filter Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to SCDOT Standard Specifications Section 804.11 (2000), ASTM D4759, and referenced standard test methods:

1. Grab Tensile Strength: 90 lbs.; ASTM D4632.
2. Tear Strength: 40 lbs.; ASTM D4533.
3. Puncture Resistance: 40 lbs.; ASTM D4833.
4. Water Flow Rate: 150 gpm per sq. ft.; ASTM D4491.
5. Apparent Opening Size: No. 50; ASTM D4751.
6. Acceptable Products:

a. AMOCO Fabrics and Fibers Co.
b. Mirafi, Inc.
c. Reemay Inc., Typar Geotextile Fabric.

D. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to SCDOT Standard Specifications Section 804.11 (2000), ASTM D4759, and referenced standard test methods:

1. Grab Tensile Strength: 200 lbs.; ASTM D4632.
2. Tear Strength: 80 lbs.; ASTM D4533.
3. Puncture Resistance: 80 lbs.; ASTM D4833.
4. Water Flow Rate: 4 gpm per sq. ft.; ASTM D4491.
5. Apparent Opening Size: No. 30; ASTM D4751.

2.3 SOURCE QUALITY CONTROL

A. See Division 1 Specification Sections, for general requirements for testing and analysis of soil materials.

B. Where fill materials are specified by reference to specific standards, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change materials and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that survey benchmarks, existing grades and contours, and intended elevations for the Work are as indicated.

B. Examine the areas and conditions under which the Work of this Section will be preformed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Verify that Clearing and Grubbing operations are completed before commencing the Work of this Section.

B. Complete any demolition and/or removal work as may be required prior to trenching operations.

C. Identify required lines, levels, contours, and datum locations.

D. See Section 31 20 00 – Earth Moving for additional requirements.

E. Locate, identify, and protect existing utilities to remain from damage.

F. Notify utility companies, as required, before removing and/or relocating existing utilities.

G. Protect structures, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by trenching operations. H. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

I. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

J. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 DEWATERING

A. Prevent surface and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Maintain the excavations in a dry condition during construction operations.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
   2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

C. Maintain the subsurface water level below the excavation subgrade elevations during excavation and construction.

   1. Material disturbed below the foundation subgrade elevation due to improper dewatering shall be removed and replaced with crushed stone or lean concrete at no additional cost to the Owner.
   2. Use sumps, pumps, drains, trenching, or well point systems as necessary to maintain a dry excavation.
   3. Dewatering by trench pumping will not be permitted if migration of fine-grained natural materials (running sand) occurs in the excavation bottom, side walls or bedding material.
   4. Dispose of water pumped from excavations in storm drains having adequate capacity, trenches, or other approved locations.

a. The Contractor is responsible to acquiring all permits necessary to discharge of water and shall protect waterways from turbidity during the operation.
b. Prevent flooding of adjacent streets, roadways, or private property.
c. Provide engines driving dewatering pumps with residential type mufflers.

3.4 EXPLOSIVES

A. Explosives: Do not use explosives.

3.5 TRENCHING

A. Notify the Architect/Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 2-feet to angle of repose or less until shored.

C. Do not interfere with 45-degree splay of foundations.

D. Cut trenches to uniform width, wide enough to provide ample working room, allow for inspection of installed utilities, and a minimum of 6 to 9-inches of clearance on both sides of pipe or conduit.

E. Excavate trenches to depth indicated or required to establish indicated slopes and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Excavate trenches to allow installation of top of pipe below the frost line.

1. Where rock is encountered, carry excavation below required elevation and backfill with a 6-inch layer of appropriate bedding backfill material.
2. For pipes or conduits less than 6-inches in nominal size, and for flat-bottomed, multipleduct conduit units, do not excavate beyond indicated depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
3. For pipes and equipment 6-inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 or circumference). Fill depressions with tamped

sand backfill. At each pipe joint, dig bell hoes to relieve pipe bell loads. Ensure continuous bearing of pipe barrel on bearing soil. F. Hand trim excavations. Remove loose matter.

G. Remove lumped subsoil, large stones, and other hard matter that could damage piping or impede consistent backfilling or compaction.

H. Stockpile excavated materials to be re-used in areas designated on site in accordance with Section 31 20 00 Earth Moving.

I. Remove unsuitable excavated materials and materials not to be re-used from the project site.

3.6 STABILITY OF EXCAVATIONS

A. General: Comply with all local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope side of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of materials excavated. Maintain sides and slopes of excavations in safe condition until completion of backfill.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross bracing, in good serviceable condition. Maintain shoring and bracing in excavations during the entire time period excavations will be open. Extend shoring and bracing as excavation progresses.

3.7 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in-place. Backfill with suitable materials per Part 2 of this Section.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill materials.

C. Until ready to backfill, maintain excavations and prevent loose soils from falling into excavations.

3.8 APPROVAL OF SUBGRADE

A. Notify Architect/Engineer when excavations have reached required subgrade.

B. If Architect/Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect/Engineer.

3.9 BACKFILL AND FILL

A. General: Place soil materials in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.

1. Under grassed areas: use satisfactory excavated or borrow soil materials.
2. Under walks and pavements: use appropriate subbase materials.
3. Under steps-on-grade: use appropriate subbase materials.

4. Under piping and conduit and equipment: use bedding subbase materials where required over rock bearing surfaces and for correction of unauthorized excavations. Shape excavation bottoms to fit bottom 90-degrees of pipe cylinder.
5. Backfill trenches: with lean concrete where trench excavations pass within 18-inches of column or wall footing and that are carried below bottom of such footings or that pass under wall footings. Place lean concrete to level of bottom of adjacent footings.

   a. Do not backfill trenches until tests and inspections have been made and backfilling has been authorized by the Architect/Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

6. Provide 4-inch thick concrete base slab support of piping or conduit less than 2'-6" below surface of roadways. After installation and testing or piping or conduit, provide minimum 4-inch thick encasement (side and top) of concrete prior to backfilling or placement of roadway subbase.

B. Place and compact backfill in excavations as promptly as work permits, but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Inspection, testing, approval, and recording of locations of underground utilities for record documents.
3. Removal concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in a manner to prevent settlement of the structure or utilities, or leave in place if required.
5. Removal of trash and debris from excavations.
6. Installation of permanent or temporary horizontal bracing on horizontally supported walls.

3.10 PLACEMENT AND COMPACTION

A. Fill areas to contours and elevations with unfrozen, dry materials.

B. Employ a placement method that does not disturb or damage other in-place work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen, or spongy subgrade surfaces.

D. Place backfill and fill materials in layers not more than 8-inches loose depth for material to be compacted by heavy compaction equipment, and not more than 4-inches in loose depth for material to be compacted with hand-operated tampers. E. Correct areas that are over-excavated.

1. Under load-bearing foundation surfaces: fill with lean concrete or engineered fill, flush to required elevation, compacted to 100-percent of maximum dry density.

2. Under other areas: fill with satisfactory fill materials, flush to required elevations, compacted to a minimum 98-percent maximum dry density.

F. Maintain optimum moisture content of fill materials to attain required compaction densities.

G. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill materials on surfaces that are muddy, frozen, or contain frost or ice.

H. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying materials uniformly around structure, piping or conduit to approximately the same elevation in each lift.

I. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by the Architect/Engineer if soil density test indicate inadequate compaction.

J. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D698:

1. Under structures, steps-on-grade, and pavements; compact top 12-inches of existing subgrade and all subsequent layers of backfill or fill material to 98-percent maximum density.
2. Under walkways; compact top 6-inches of existing subgrade and all subsequent layers of backfill or fill material to 95-percent maximum density.
3. Under lawns or unpaved areas; compact top 6-inches of existing subgrade and all subsequent layers of backfill or fill material to 90-percent maximum density.
4. Under existing pavements to removed and replaced for utility installation; compact top 24inches of existing subgrade and all subsequent layers of backfill or fill material to 98percent maximum density.

K. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on the surface during or subsequent to compaction operations.

1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
2. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory level.

L. Make grade changes gradual. Blend slopes into level areas.

M. Reshape and re-compact fills subjected to vehicular traffic.

N. Remove surplus fill materials from site.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

B. Stockpile excavated materials acceptable for backfill and fill where directed.

C. Stockpile excavated topsoil to be reused on-site; remove remainder from site.

D. Stockpile excavated subsoil, not placed directly into fill areas and to be reused at a later time, onsite; remove remainder from site.

3.12 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.1-foot from required elevation.

B. Top Surface of Finish Grade: Plus or minus 1/2-inch from required elevation.

3.13 FIELD QUALITY CONTROL

A. See Section 31 20 00 – Earth Moving for addition compaction density testing requirements.

B. Testing Agency: The Owner will engage a qualified independent Geotechnical Engineering Testing Agency to perform field quality control testing.

C. Allow Testing Agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

D. Testing Agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2922, and ASTM D2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Trench Backfill: At each compacted initial and final backfill layer, at least one (1) test for each 150 feet or less of trench length, but no fewer than two (2) tests.

E. When Testing Agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.14 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Prevent displacement of banks and keep loose soil from falling into excavations; maintain soil stability.

C. Protect bottom of excavation and soil adjacent to and beneath foundations from freezing.

D. Keep footing excavations free from water. Pump out excavations containing water. Do not pour foundations when excavations are wet or not properly compacted.

E. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

F. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property. B. Leave site clean and raked, ready to receive final surfaces.

END OF SECTION 31 2333

SECTION 31 2500 – SEDIMENTATION AND EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The extent of soil erosion and sedimentation control work is shown on the Drawings and by the requirements of this section.

B. Soil erosion and sedimentation control measures shall include all temporary and permanent means of protection and trapping soils on the construction site during land disturbing activities to include.

1. Construction of temporary site gravel construction entrance
2. Installation, and subsequent removal, of temporary perimeter silt fencing.
3. Installation of permanent rip-rap inlet and outlet protection.
4. Removal of temporary inlet protection.
5. Temporary Grassing of disturbed areas.

1.3 RELATED SECTIONS

A. Section 31 2000 – Earth Moving.

B. Section 31 3730 – Riprap.

C. Section 32 1000 – Aggregate Base Course.

D. Section 32 9200 – Lawns and Grassing.

1.4 PURPOSES

A. The purpose of this section is to achieve the following goals:

1. Minimize soil exposure by proper timing of grading and construction operations.
2. Retain existing vegetation whenever feasible.
3. Vegetate and mulch disturbed areas as soon as possible.
4. Divert runoff from disturbed areas.
5. Minimize length and steepness of slopes where practical.
6. Reduce runoff velocities with sediment barriers or by increasing roughness with stone riprap.
7. Trap sediment on-site.
8. Inspect and maintain sedimentation and erosion control measures.

1.5 REFERENCES

A. South Carolina Stormwater Management and Sedimentation Control Handbook for Land Disturbance Activities, by SCDHEC.

B. South Carolina Department of Highways and Public Transportation, “Standard Specifications for Highway Construction”, latest Edition, hereinafter referred to as SCDOT Specifications.

1.6 SUBMITTALS

A. Product Data: Provide manufacture’s technical product data and installation instructions for soil erosion and sedimentation control materials and products.

B. Schedule of Operations: Submit schedule of proposed operations, including program for erosion control measures, maintenance of control facilities, and vegetative practices. Show anticipated starting and completion dates for land-disturbing activities, including excavation, filling and rough grading, finish grading, construction of temporary and permanent erosion control measures, and disposition of temporary erosion control measures.

C. Contractor shall sign “Co-Permittee Agreement” and return to Architect/Engineer before beginning any construction activities.

1.7 PROJECT CONDITIONS

A. Portions of the Work of this Section must be performed prior to any large-scale grubbing or stripping operations.

B. The Contractor shall coordinate the Work of this section with other items of work, such as swales, to ensure all surface water from disturbed areas is routed through the detention/sedimentation ponds.

C. Prior to extensive use of the site, the Contractor shall construct the site gravel construction entrance. The intent of the site gravel construction entrance is to provide for minimal transportation of sediments into the public right-of-way.

D. Construct and maintain temporary erosion control measures until such time as permanent paving, plantings, and restoration of natural areas is effective in controlling erosion/sediment from the site. Extent of sedimentation/erosion control construction shall be the responsibility of the Contractor, based on actual site conditions at the project.

E. Protect adjacent and downstream properties from siltification resulting from erosion of project graded areas.

F. The Contractor shall comply with all requirements of the approved permits from Lexington County, SCDHEC and SCDOT.

PART 2 - PRODUCTS

2.1 SILT FENCING

A. General: Provide silt fence specifically manufactured for the application intended and as follows:

B. Silt Fence Fabric:

1. Acceptable Products:

a. AMOCO Fabrics and Fibers Co.; '2125'.
b. Mirafi Inc.; '100X'.
c. Nicolon Corp.; 'Kontrol'.
d. TNS Advanced Technologies, Inc.; 'W100'.

2. Characteristics:

a. Type: Woven, polypropylene, geotextile fabric; 30-inch minimum width.
b. Apparent Opening Size (AOS): #20 to #40 U.S. Standard Sieve; ASTM D4751.
c. Grab Tensile Strength: Minimum 110 lbs.; ASTM D4632.
d. Grab Elongation: Maximum 30%; ASTM D4632.
e. Bursting Strength: Minimum 275 psi; ASTM D3786.
f. Filter Efficiency: Minimum 85%.
g. Slurry Flow Rate: Maximum 0.3 gpm/sf; ASTM D4491.
h. Permeability: Maximum 20 gpm/sf; ASTM D4491. C. Wire Fabric:

1. Support standard strength silt fence fabric with wire fence of the following properties:

a. Wires: Minimum 14 gauge.
b. Mesh Spacing: Maximum 6-inches.

D. Posts: Either 1.33-lbs/lf steel, minimum 4-feet in length. Make sure that steel posts have projections to facilitate fastening of the fabric.

1. Space posts for silt fence fabric with wire mesh support at a maximum of 8-feet apart. Support posts should be driven securely into the ground to a minimum of 18-inches.
2. Space posts for silt fence fabric without wire mesh support to a maximum of 6-feet apart. Support posts should be driven securely into the ground to a minimum of 18-inches.

2.2 OTHER MATERIALS

A. Erosion Control Matting: Curlex Excelsior Control Blanket or Equal.

B. Stone Rip-Rap: Crushed Stone with weight gradation of 20 to 200 lbs. per piece and a median diameter of 8-inches. Meet SCDOT Specifications.

C. Filter Stone: Stone size in accordance with ASTM D448 size No. 1 {1-1/2 to 3-1/2 inch diameter}. Meet SCDOT Specifications.

D. Gravel: #57 Stone per SCDOT Specifications.

E. Filter Fabric: Conform to ASTM E1682 & E1683.

2.3 TEMPORARY GRASSING MATERIALS A.

Grass Seed:

1. General: All grass seed shall be free from noxious weeds, grade A recent crop, recleaned and treated with appropriate fungicide at time of mixture. Deliver to site in original sealed containers with dealer's guarantee as to the year grown, percentage of purity, percentage of germination, and the date of the test by which the percentages of purity and germination were determined. All seed sown shall have a date of test within six months of the date of sowing.
2. Type of Seed: Refer to Section 32 9200 – Lawns and Grassing. B. Fertilizer:

    1. Regular Type:

        a. Nitrogen content derived from organic or inorganic sources, bearing manufacturer's statement of analysis.
        b. Minimum requirements: 12%-nitrogen, 4%-phosphoric acid, and 8%-potash.

    2. Slow Release Type:

        a. 50% of nitrogen content to be slow-release form, content derived from organic or inorganic sources, bearing manufacturer's statement of analysis.
        b. Minimum requirements: 10%-nitrogen, 10%-phosphoric acid, and 10%-potash.

    3. Commercial Mixed Type:

        a. Nitrogen content derived from organic or inorganic sources, bearing manufacturer's statement of analysis.
        b. Minimum requirements: 10%-nitrogen, 10%-phophoric acid, and 10%-potash. C.

Mulch: Clean, seed-free straw of hay, wheat, rye, oats or barley.

D. Hydromulch: Wood cellulose fiber containing no germination-inhibiting or growth-inhibiting agents. Characteristics shall be as follows:

1. Percent Moisture Content: 9.0% (±3.0%).
2. Percent Organic Matter: 99.2% (±0.8%).
3. Percent Ash Content: 0.8% (±0.2%).
4. pH: 4.8 (±0.5).
5. Water holding capacity: Minimum 40-oz. water/3.5-oz. fiber. E. Asphalt Emulsion:

Meeting ASTM D977, Grade SS1.

F. Seeding

Recommendations:

1. For Late Winter and Early Spring Seeding:

    a. Seeding mixture: Rye (grain) seed at 220-lbs./acre and Unhulled Bermuda seed at 80lbs/acre.

        1) Omit Bermuda seed when duration of temporary cover is not to extend beyond June.

    b. Soil Amendments: Follow recommendations of soil tests or apply 2,000-lbs/acre ground agricultural limestone and 750-lbs/acre 10-10-10 fertilizer.

c. Mulch: Apply 4,000-lbs/acre of straw. Anchor straw by tacking with asphalt, netting or a mulch-anchoring tool. A disk with blades set nearly straight can be used as a mulch-anchoring tool.
d. Maintenance: Re-fertilize if growth is not fully adequate. Re-seed, re-fertilize, and mulch immediately following erosion or other damage.

2. For Summer Seeding:

a. Seeding mixture: Hulled Bermuda seed at 80-lbs./acre.
b. Soil Amendments: Follow recommendations of soil tests or apply 2,000-lbs/acre ground agricultural limestone and 750-lbs/acre 10-10-10 fertilizer.
c. Mulch: Apply 4,000-lbs/acre of straw. Anchor straw by tacking with asphalt, netting or a mulch-anchoring tool. A disk with blades set nearly straight can be used as a mulch-anchoring tool.
d. Maintenance: Re-fertilize if growth is not fully adequate. Re-seed, re-fertilize, and mulch immediately following erosion or other damage.

3. For Fall Seeding;

a. Seeding mixture: Rye (grain) seed at 220-lbs/acre.
b. Soil Amendments: Follow recommendations of soil tests or apply 2,000-lbs/acre ground agricultural limestone and 1,000-lbs/acre 10-10-10 fertilizer.
c. Mulch: Apply 4,000-lbs/acre of straw. Anchor straw by tacking with asphalt, netting or a mulch-anchoring tool. A disk with blades set nearly straight can be used as a mulch-anchoring tool.
d. Maintenance: Re-fertilize if growth is not fully adequate. Re-seed, re-fertilize, and mulch immediately following erosion or other damage. Top-dress with 50-lbs/acre of nitrogen in March. If it is necessary to extend temporary coverage beyond June 15, overseed with 80-lbs/acre of Unhulled Bermuda seed in late February or early March.

PART 3 - EXECUTION

3.1 GENERAL

A. All disturbed soil areas, except those to support structures, shall be graded and protected from erosion by grassing or other protection measures. Stormwater conveyance systems shall have sediment barriers installed at all entrances, intersections, changes in direction, discharge points, and other locations as indicated on the drawings.

B. Schedule grading operations to minimize exposure of graded surfaces prior to installation of permanent construction.

C. Maintain large graded areas as flat as possible to minimize runoff.

D. Where slopes of 4-horizontal to 1-vertical (4:1) are indicated, construct a temporary sediment barrier (diversion berm) at the top of the slope to cause water to flow to a controlled slope drain. In no circumstances shall surface water be allowed to flow uncontrolled down graded slopes.
1. Slope Drains: Provide temporary drains to convey surface water down slopes. Provide drains with a top apron to anchor drain and to direct water. Place stone rip-rap at drain outlets to a minimum 6-inch thickness to prevent scour.

3.2 SEQUENCE OF WORK

A. The intent of the Work of this Section is to provide for the orderly installation of preventative measures to control the migration of sediments and the damage caused by erosion from stormwater events. The Contractor shall be cognizant of the goals to be achieved and shall organize his work to effectively accomplish the goals. Whenever specified measures, properly constructed and maintained, are not providing the degree of control of sediments and erosion that is deemed satisfactory, the Contractor shall notify the Architect/Engineer and shall propose any additional measures which may be justified.

B. In order to minimize problems associated with stormwater events, and to provide for early installation on the site of the construction administration trailer, the Contractor shall stage his work in the following general order.

1. Erect any sediment control measures such as sediment traps, diversion structures, silt fencing, etc. in the immediate vicinity of any work prior to disturbing the existing ground. Immediately grass any areas that do not require additional disturbance.
2. Clear, grub, and grade the construction access roads. Install any required storm drainage piping. Install the gravel construction entrance in accordance with Section 027210Aggregate Base Course.
3. Install Silt Fencing as shown on the Drawings.
4. Flag grubbing limits and begin grubbing operations.
5. Grub and grade site, installing storm drainage and erosion control measures as soon as practical while work progresses.
6. Grass all graded and disturbed areas as the work progresses. DO NOT DELAY GRASSING!!
7. Inspect all sediment and erosion control devices at least weekly and after each rain event. Repair any damaged portions immediately. All inspection shall be recorded in the Stormwater Pollution Prevention binder and kept on-site.

3.3 INSTALLATION OF TEMPORARY GRASSING

A. All grassing shall comply with the requirements of Section 32 9200 – Lawns and Grassing.

B. Verify soil surface is ready to receive temporary grassing. A good seedbed is well-pulverized, loose, and uniform. Where hydro-seeding methods are used, the surface may be left with a more irregular surface or large clods and stones.

C. Apply Temporary Seeding per seeding recommendations listed for the appropriate time of year.

1. Liming: Apply lime according to soil test recommendations. If the pH (acidity) of the soil is not known, an application of ground agricultural limestone at the rate of 1 to 1-1/2 tons/acre on coarse-textures soils and 2 to 3 tons/acre on fine-textured soils is usually sufficient. Apply limestone uniformly and incorporate into the top 4 to 6-inches of soil. Soils with a pH of 6 or higher do not need lime additive.
2. Fertilizer: Base applications rates on soil tests. When these are not possible, apply a 1010-10 grade fertilizer at 700 to 1,000 lbs/acre. Both fertilizer and lime should be incorporated into the top 4 to 6-inches of soil. If a hydraulic seeder is used, do not mix seed and fertilizer more than 30-minutes before application.
3. Surface Roughening: If recent tillage operations have resulted in a loose surface condition, additional roughening may not be required except to break up large clods. If rainfall causes the surface to become sealed or crusted, loosen soil just prior to seeding

by disking, raking, harrowing, or other suitable methods. Groove or furrow slopes steeper than 3-horizontal to 1-vertical (3:1) on the contour before seeding.

4. Evenly apply seed using a cyclone seeder (broadcast), drill, cultipacker seeder, or hydroseeder. Use seeding rates per recommendations given previously in this section. Broadcast seeding and hydro-seeding are appropriate for sleep slopes where equipment cannot be driven. Hand broadcasting is not recommended because of the difficulty of achieving uniform distribution.

   a. Small grains should be planted not more than 1-inch deep, and grasses and legumes not more than 1/2-inch deep. Broadcast seed must be covered by raking or chain dragging, and then lightly firmed with a roller or cultipacker. Hydroseeded mixtures should include wood-fiber (cellulose) mulch.

5. Mulching: The use of appropriate mulch will help ensure grass establishment under normal conditions and is essential to seeding success under harsh site conditions. Harsh site conditions include:

   a. Seeding in fall for winter cover (wood-fiber mulches are not considered adequate for this use).
   b. Slopes steeper than 3:1.
   c. Excessively hot or dry weather.
   d. Adverse soils (shallow, rocky, or high in clay or sand content).
   e. Areas receiving concentrated flow.

6. If the area to be mulched is subject to concentrated water flow, as in a channel, anchor mulch with netting.
7. Maintenance: Reseed and mulch areas where seedling emergence is poor, or where erosion occurs, as soon as possible. Do not mow. Protect from traffic as much as possible.

3.4 INSTALLATION OF SEDIMENT BARRIERS

A. Silt Fencing for Sheet Flow Applications:

1. Install the silt fencing in the locations indicated on the Drawings. Adjust fencing as directed by the Architect/Engineer to allow for proper functioning.
2. Silt fencing sections shall be installed along a constant contour elevation as much as practical. Avoid concentration of flows through fencing caused by installation at varying elevations.
3. Follow the manufacturer's instructions for proper installation procedures of overlapping sections, as well as depth of bury for posts.
4. Install per the following general directions:

   a. Excavate a 6-inch deep, 8-inch wide trench on the upstream side of the desired fence line location along the entire length of the proposed barrier.
   b. Unroll the silt fence fabric material (or pre-assembled assembly) and attach to posts, position the posts behind the trench (downhill side), and hammer the posts at least 18-inches in the ground.
   c. Ensure that the height of the silt fence does not exceed 36-inches above the ground surface. (Higher fences may impound volumes of water sufficient to cause failure of the structure.)

d. Lay a minimum of 6-inches of the bottom portion of the silt fencing fabric into the bottom of the trench to prevent undermining by storm water runoff.
e. Backfill the trench with stone and compact. Compaction is necessary to prevent runoff from eroding the backfill.

f. Inspect and repair or replace damaged silt fencing promptly. Remove silt fencing when the uphill sloped areas have been permanently stabilized. B. Gravel Check Dams for Channel Flow Applications:

1. Install gravel check dams per the Construction Details on the Drawings and as follows:

a. Place the stone to the lines and dimensions shown in the Drawings, on a filter fabric foundation.
b. Keep the center stone section at least 9-inches below natural grade level where the dam abuts the channel banks.
c. Extend stone at least 1-1/2 feet beyond the ditch banks to keep overflow water from undercutting the dam as it re-enters the channel.
d. Set spacing for the dam to assure that the elevation at the top of the lower dam is the same as the toe elevation of the upper dam.
e. Protect the channel downstream from the lowest check dam, considering that water will flow over and around the dam.
f. Make sure that the channel reach above the most upstream check dam is stable.
g. Ensure that channel appurtenances, such as culvert entrances below check dams, are not subject to damage or blocking from displaced stones.
h. Inspect check dams and channels for damage after each rain event.
i. Anticipate submergence and deposition above the check dam and erosion from high flows around the edges of the check dam. Correct all damage immediately. If significant erosion occurs between check dams, install a protective rip-rap liner in that portion of the channel.
j. Remove sediment accumulated behind check dams as needed to prevent damage to channel vegetation, allow the channel to drain through the check dam, and prevent large flows from carrying sediment over the check dam. Add stone to dams as needed to maintain design height and cross section. C. Silt Fence Inlet Sediment Barriers:

1. Install per the Construction Details on the Drawings.

3.5 INSTALLATION OF RIP-RAP

A. Install quantities shown on the Drawings and per the Construction Details.

B. Place by hand on undisturbed soil material or compacted soil covered by filter fabric. Place to form a compact layer of approximately 12-inches in thickness. Rip-rap should be laid on the filter fabric leaving no visible fabric.
C. Refer to Specification Section 31 3700 – Rip Rap.

3.6 STORM DRAINAGE SYSTEM

A. Construct storm drainage system as expediently as possible as a permanent erosion control measure. Surface water may be directed into complete portions of drainage system as soon as practicable.

B. Maintain temporary sediment barriers around drainage structures until all areas draining to structure have been permanently stabilized, to prevent washing of sediment into storm drainage system or off site.

C. Flush drainage lines between drainage structures as required during construction and after establishment of permanent erosion control measures to remove collected debris.

3.7 GROUND COVER

A. Protect exposed soils having a slope of 3:1 or greater with ground cover, except as otherwise specified herein.

B. Ground cover may consist of any effective erosion prevention treatment such as straw mulch, stone base, plastic sheeting, hydro-seeding, or installation of temporary or permanent grassing or plantings, as applicable.

C. All grassing and planting operations shall include mulching as stabilization until ground cover planting is effective.

3.8 DETENTION/RETENTION PONDS

A. Install per the Drawings and Construction Details.

B. Create diversion berms along top as necessary to prevent slope erosion.

C. Provide surveyed as-built drawings; tie control points to those used for construction purposes.

D. All sediment shall be removed and pipes/structures/rip-rap flushed clean.

E. Ground cover shall be established over all areas disturbed by construction or otherwise indicated on the Drawings prior to final acceptance.

3.9 REMOVAL OF TEMPORARY EROSION CONTROL DEVICES

A. As soon as permanent erosion control devices are established, and SCDHEC approval has been received, the Contractor may remove temporary devices, including sediment traps, sediment barriers, berms, slope drains, and other devices. This includes redistributing collected amounts of silt over the project site.

B. Remove all debris resulting from temporary erosion from the project site.

C. Check and clean adjacent existing drainage structures of material introduced during construction.

3.10 POLLUTION PREVENTION

A. The Contractor shall conduct all operations and shall instruct his Sub-Contractors, if any, to conduct their operations in a safe and pollution free manner.

B. The Contractor shall establish dedicated areas for the parking and servicing of all vehicles. Any petroleum products that are deposited on the ground, for any reason, shall be promptly excavated along with any contaminated soils and disposed of at a permitted disposal site.

C. No containers, bags, cans, rubbish, litter or other debris of any sort will be allowed to remain on the site. Any debris resulting from the Contractor's operations shall be removed daily and disposed of off-site.

END OF SECTION 31 2500

SECTION 31 3700 – RIPRAP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The extent of permanent Rip-Rap outlet protection work is shown on the Drawings and by the requirements of this section.

1.3 RELATED SECTIONS

A. Section 31 2000 Earth Moving.

B. Section 31 2500 – Sedimentation and Erosion Control.

C. Section 33 4000 – Storm Drainage System.

D. Section 32 9200 – Lawns and Grassing.

1.4 REFERENCES

A. South Carolina Department of Highways and Public Transportation, “Standard Specifications for Highway Construction”, 2000 Edition, hereinafter referred to as SCDOT Specifications.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with SCDOT Standard Specifications.

1. Maintain one (1) copy on-site.

B. The Contractor shall comply with all requirements of the approved permits from Lexington County, SCDHEC and SCDOT.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rip-Rap: Provide in accordance with SCDOT Standard Specifications.

B. Rip-Rap: Granite type; broken stone or irregular shaped rock; solid and nonfriable; 6-inch minimum and 10-inch maximum size, weight gradation of 20 to 200-lbs. per piece. C. Aggregate: SCDOT #57 Stone and SCDOT #67 Stone.

D. Geotextile Fabric: Non-biodegradable, woven polypropylene fabric, per SCDOT Standard Specifications Sections 804.11 and 804.18.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not place rip-rap over frozen or spongy subgrade surfaces.

3.2 PLACEMENT

A. Place geotextile fabric over substrate, lap edges and ends.

B. Place rip-rap at culvert pipe ends, embankment slopes, storm drainage outlets and inlets, and as otherwise indicated.

C. Installed Thickness: 12-inches average minimum, as per Drawings.

D. Place rip-rap on the filter fabric leaving no visible fabric.

E. Recess rip-rap such that the top of rip-rap is the same elevation as the proposed finish grade.

END OF SECTION 31 3700

SECTION 32 1300 – PORTLAND CEMENT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. This Section includes exterior Portland Cement Concrete Pavement for the following:

1. Driveways and Roadways.
2. Parking lots.
3. Curbs and Gutters.
4. Sidewalks and Outside Pads with integral turndowns.
5. Miscellaneous Concrete.

1.3 RELATED SECTIONS

A. Section 31 2000 – Earth Moving.

B. Section 31 2333 – Trenching and Backfill for Site Utilities.

C. Section 33 3000 – Sanitary Sewer System.

D. Section 33 4000 – Storm Drainage System.

E. Section 32 1000 – Aggregate Base Course.

F. Section 32 1216 – Hot-Mix Asphalt Concrete Paving.

G. Section 32 1713 – Parking Bumpers.

H. Division 3 Specification Sections for Cast-in-Place Concrete.

I. Division 9 Specification Section for Painting.

1.4 REFERENCES

A. See Division 3 Specification Sections for applicable references.

B. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991.

C. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute International; 1996.

D. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 1989.

E. ACI 305R – Hot Weather Concreting; American Concrete Institute International; 1991.

F. ACI 306R – Cold Weather Concreting; American Concrete Institute International; 1988.

G. ASTM A185 – Standard Specification for Welded Steel Wire Fabric, Plain, for Concrete Reinforcement; 1994.

H. ASTM A497 – Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement; 1995.

I. ASTM A615/A615M – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 1996a.

J. ASTM C33 – Standard Specification for Concrete Aggregates; 1993.

K. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 1996.

L. ASTM C94 – Standard Specification for Ready-Mixed Concrete; 1996.

M. ASTM C150 – Standard Specification for Portland Cement; 1996.

N. ASTM C173 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 1994a.

O. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete; 1995.

P. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 1997.

Q. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete; 1992.

R. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete; 1996a.

S. ASTM C685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 1995a.

T. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete; 1995.

U. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction; 1984 (Re-Approved 1996).

1.5 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.6 SUBMITTALS

A. See Division 1 Specification Sections for submittal procedures.

B. Quality Control Submittals: Submit the following information related to quality assurance requirements.

1. Design Date: Submit proposed mix designs and test data before concrete operations begin. Identify for each mix submitted, the method by which proportions have been selected.

   a. For mix designs based on field experience, include individual strength test results no older than six (6) months from time of submission, standard deviations, and required average compressive strength calculations.
   b. Indicate quantities of each ingredient per cubic yard of concrete.
   c. Indicate type and quantity of admixtures proposed to be required.

2. Test Reports: Submit laboratory test reports for all testing specified.
3. Certifications: Submit affidavits from an independent test agency certifying that all materials furnished under this section conform to these specifications.
4. Certifications: Provide certification from manufacturers of concrete admixtures that chloride content complies with specified requirements.
5. Certifications: Submit mill test certificates for all reinforcing steel furnished under this section, showing physical and chemical analysis.
6. Placement Schedule: Submit concrete placement schedule prior to start of any concrete placement operations. Include locations of all joints indicated on the Drawings, plus anticipated construction joints.
7. Submit batch tickets complying with ASTM C685 or delivery tickets complying with ASTM C94, as applicable, for each concrete batch used in the Work.

   a. Include on ticket the additional information specified in the ASTM document.

8. Hot Weather Concrete Placement: Submit description of planned protective measures. C.

Product Data: For each type of manufactured material and product indicated.

D. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

F. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials and aggregates.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or adhesive.
8. Joint fillers.

G. Design Data: Indicate pavement thickness, designed concrete strength, reinforcement, and typical details.

H. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301, SCDOT Standard Specifications, and local governing authority standards.

B. Installer Qualifications: An experienced installer who has completed concrete pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.

G. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Specification Sections.

1. Before submitting design mixes, review concrete pavement mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with concrete pavement to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixes.
c. Ready-mix concrete producer.
d. Concrete subcontractor.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Follow recommendations of ACI 305R when placing concrete during hot weather.

B. Follow recommendations of ACI 306R when placing concrete during cold weather.

C. Do not place concrete when base surface temperature is less than 40 deg F.

1.9 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces complying with ACI 301. See Division 3 Specifications for additional information.

1. Use flexible or curved forms for curves of a radius 100-feet or less.

B. Form-Release Agent: Commercially formulated form-release agent with a maximum of 350-mg/l volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Reinforcing Steel and Wire Fabric: See Division 3 Specification Sections for additional information.

B. Plain-Steel Welded Wire Fabric: ASTM A185, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded Wire Fabric: ASTM A497, flat sheet.

D. Epoxy-Coated Welded Wire Fabric: ASTM A884, Class A, plain steel.

E. Reinforcement Bars: ASTM A615, Grade 60, deformed.

F. Epoxy-Coated Reinforcement Bars: ASTM A775; with ASTM A615, Grade 60, deformed bars.

G. Steel Bar Mats: ASTM A184; with ASTM A615, Grade 60, deformed bars; assembled with clips.

H. Plain Steel Wire: ASTM A82, as drawn.

I. Epoxy-Coated Wire: ASTM A884, Class A coated, plain steel.

J. Joint Dowel Bars: Plain steel bars, ASTM A615, Grade 60. Cut bars true to length with ends square and free of burrs.

K. Epoxy-Coated Joint Dowel Bars: ASTM A775; with ASTM A615, Grade 60, plain steel bars.

L. Tie Bars: ASTM A615, Grade 60, deformed.

M. Hook Bolts: ASTM A307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

N. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiberreinforced concrete of greater compressive strength than concrete, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer coated wire bar supports.

O. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

2.3 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Concrete Materials: See Division 3 Specification Sections for additional information.

C. Portland Cement: ASTM C150, Type I or II.

1. Fly Ash: ASTM C618, Class F or C.
2. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

D. Blended Hydraulic Cement: ASTM C595M, Type IS, portland blast-furnace slag cement.

E. Blended Hydraulic Cement: ASTM C595M, Type IP portland pozzolan cement.

F. Blended Hydraulic Cement: ASTM C595M, Type I (PM) pozzolan-modified portland cement.

G. Blended Hydraulic Cement: ASTM C595M, Type I (SM) slag-modified portland cement.

H. Aggregate: ASTM C33, uniformly graded, from a single source, with coarse aggregate as follows:

1. Class: 4M.*
2. Maximum Aggregate Size: 1-inch nominal.*
3. Do not use fine or coarse aggregates containing substances that cause

spalling. I. Water: ASTM C94.

2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1-percent watersoluble chloride ions by mass of cement and to be compatible with other admixtures.

B. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

C. Water-Reducing Admixture: ASTM C494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C494, Type F or Type G.

E. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.

F. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

E. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B.

1. Provide material that has a maximum volatile organic compound (VOCs) rating of 350-mg pr liter.

F. Clear Waterborne Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B.

G. White Waterborne Membrane-Forming Curing Compound: ASTM C309, Type 2, Class B.

H. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Evaporation Retarder:

a. Cimfilm; Axim Concrete Technologies.
b. Finishing Aid Concentrate; Burke Group, LLC (The).
c. Spray-Film; ChemMasters.
d. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
e. Sure Film; Dayton Superior Corporation.
f. Eucobar; Euclid Chemical Co.
g. Vapor Aid; Kaufman Products, Inc.
h. Lambco Skin; Lambert Corporation.
i. E-Con; L&M Construction Chemicals, Inc.
j. Confilm; Master Builders, Inc.
k. Waterhold; Metalcrete Industries.
l. Rich Film; Richmond Screw Anchor Co.
m. SikaFilm; Sika Corporation.
n. Finishing Aid; Symons Corporation.
o. Certi-Vex EnvioAssist; Vexcon Chemicals, Inc.

2. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound:
a. AH Curing Compound #2 DR; Anti-Hydro International, Inc.
b. Res-X Cure All Resin; Burke Group, LLC (The).
c. RX Cure; Conspec Marketing & Manufacturing Co., Inc.

d. Day-Chem Rez Cure; Dayton Superior Corporation.
e. Kurez DR; Euclid Chemical Co.
f. Nitocure S; Fosroc.
g. #64 Resin Cure; Lambert Corporation.
h. L&M Cure DR; L&M Construction Chemicals, Inc.
i. 3100-Clear; W. R. Meadows, Inc.
j. Seal N Kure FDR; Metalcrete Industries.
k. Rich Cure; Richmond Screw Anchor Co.
l. Resi-Chem C309; Symons Corporation.
m. Horncure 30; Tamms Industries Co., Div. of LaPorte Construction Chemicals North America, Inc.
n. Uni Res 150; Unitex.
o. Certi-Vex RC; Vexcon Chemicals, Inc.

3. Clear Waterborne Membrane-Forming Curing Compound:

    a. AH Curing Compound #2 DR WB; Anti-Hydro International, Inc.
    b. Aqua Resin Cure; Burke Group, LLC (The).
    c. Safe-Cure Clear; ChemMasters.
    d. W.B. Resin Cure; Conspec Marketing & Manufacturing Co., Inc.
    e. Day Chem Rez Cure (J-11-W); Dayton Superior Corporation.
    f. Nitocure S; Fosroc.
    g. Aqua Kure-Clear; Lambert Corporation.
    h. L&M Cure R; L&M Construction Chemicals, Inc.
    i. 1100 Clear; W. R. Meadows, Inc.
    j. Resin Cure E; Nox-Crete Products Group, Kinsman Corporation.
    k. Rich Cure E; Richmond Screw Anchor Co.
    l. Resi-Chem Clear Cure; Symons Corporation.
    m. Horncure 100; Tamms Industries Co., Div. of LaPorte Construction Chemicals North America, Inc.
    n. Hydro Cure; Unitex.
    o. Certi-Vex Enviocure; Vexcon Chemicals, Inc.

4. White Waterborne Membrane-Forming Curing Compound:

    a. AH Curing Compound #2 WB WP; Anti-Hydro International, Inc.
    b. Aqua Resin Cure; Burke Group, LLC (The).
    c. W.B. Resin Cure; Conspec Marketing & Manufacturing Co., Inc.
    d. Thinfilm 450; Kaufman Products, Inc.
    e. Aqua Kure-White; Lambert Corporation.
    f. L&M Cure R-2; L&M Construction Chemicals, Inc.
    g. 1200-White; W. R. Meadows, Inc.
    h. White Pigmented Resin Cure E; Nox-Crete Products Group, Kinsman Corporation.
    i. Rich Cure White E; Richmond Screw Anchor Co.
    j. Resi-Chem High Cure; Symons Corporation.
    k. Horncure 200-W; Tamms Industries Co., Div. of LaPorte Construction Chemicals North America, Inc.
    l. Hydro White 309; Unitex.

A.

2.6 RELATED MATERIALS

Expansion- and Isolation-Joint-Filler Strips: Recycled Rubber Equal to ASTM D1752.

B. Pavement-Marking Paint: Latex, water-base emulsion; ready mixed; complying with FS TTP1952.

1. Color: As indicated.
2. Color: Blue for handicapped requirements, white elsewhere.
3. Color: Blue for handicapped requirements, yellow for fire lanes, white elsewhere.

C. Wheel Stops: Precast, air-entrained concrete; 2500-psi minimum compressive strength; approximately 6 inches high, 9 inches wide, and 84 inches long. Provide chamfered corners and drainage slots on underside, and provide holes for dowel-anchoring to substrate. See Section 32 17 13 – Parking Bumpers for additional information.

1. Dowels: Galvanized steel, diameter of 3/4 inch, minimum length 10 inches.

D. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50-percent aluminum oxide and not less than 25-percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

E. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

F. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

G. Chemical Surface Retarder: Water-soluble, liquid set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

H. Available Surface Retarder Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Chemical Surface Retarder:

a. True Etch Surface Retarder; Burke Group, LLC (The).
b. Exposee; ChemMasters.
c. Delay S; Conspec Marketing & Manufacturing Co., Inc.
d. Concrete Surface Retarders; Euclid Chemical Co.
e. Expose; Kaufman Products, Inc.
f. Surftard; Metalcrete Industries.
g. Crete-Nox TA; Nox-Crete Products Group, Kinsman Corporation.
h. Lithotex; L. M. Scofield Co.
i. Rugasol-S; Sika Corporation.

A.

j. Certi-Vex Envioset; Vexcon Chemicals, Inc.

2.7 CONCRETE MIXES

Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience methods. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

1. Do not use the Owner's field quality-control testing agency as the independent testing agency.
2. Limit use of fly ash to 25-percent of cement content by weight.

B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 3,000 psi, typical unless otherwise specified or indicated.
2. Compressive Strength (28 Days): 3,500 psi, where indicated.
3. Compressive Strength (28 Days): 4,000 psi, where indicated.
4. Maximum Water-Cementitious Materials Ratio: 0.45.
5. Slump Limit at Point of Placement: 3-inches.

a. Slump Limit for Concrete containing High-Range Water-Reducing Admixture (Superplasticizers): Not more than 8-inches after adding admixture to site-verified 2 to 3-inch slump concrete.

C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.

D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25-percent.
2. Combined Fly Ash and Pozzolan: 25-percent.
3. Ground Granulated Blast-Furnace Slag: 50-percent.
4. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50-percent Portland cement minimum, with fly ash or pozzolan not exceeding 25-percent.

E. Admixtures: Add acceptable admixtures as recommended by ACI A211.1 and at rates recommended by manufacturer.

F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus or minus 1½ -percent:

1. Air Content: 6.0-percent for 1-inch maximum aggregate.*

G. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

H. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd..

A.

2.8 CONCRETE MIXING

Ready-Mixed Concrete: Comply with requirements and with ASTM C94 and ASTM C1116.

1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75-minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60-minutes.

B. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C94. Mix concrete materials in appropriate drum-type batch machine mixer, complying with ASTM C685.

1. For mixers of 1 cu. yd. or smaller capacity, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixers of capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added.

C. Transit Mixers: Comply with ASTM C94.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade, granular subbase, and or aggregate base course is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of subgrade, granular subbase, and or aggregate base course are correct.

C. Proof-roll prepared subbase and aggregate base course using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

D. Notify Architect/Engineer of unsatisfactory conditions. Do not begin paving work until deficient base course areas have been corrected and are ready to receive paving.

3.2 PREPARATION

A. General: Immediately before placing concrete, remove loose and deleterious material from compacted substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

3.3 AGGREGATE BASE COURSE

A.

A. See Section 32 1000 – Aggregate Base Course for the base construction for work of this section.

3.4 EDGE FORMS AND SCREED CONSTRUCTION

Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24-hours after concrete placement.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.

1. Apply epoxy repair coating to uncoated or damaged surfaces of epoxy-coated reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one (1) full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats. F. Place reinforcement as indicated in the Drawings.

G. Interrupt reinforcement at contraction and expansion joints.

H. Place dowels and/or reinforcement to achieve pavement and curb alignments as detailed.

I. Provide doweled joints at 12-inches on center at interruptions of concrete with one (1) end of dowel set in capped sleeve to allow longitudinal movement.

3.6 JOINTS

A. General: Construct construction, isolation, and contraction joints and tooled edgings true to line with faces, perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated. B. Align curb, gutter, and sidewalk joints.

C. Construction Joints: Set construction joints at side and end terminations of pavements and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.

1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip paving, unless otherwise indicated.
3. Provide tie bars at sides of paving strips where indicated.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
5. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Isolation/Expansion Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Place ½-inch wide joints at intervals indicated on the Drawings and to separate paving from vertical surfaces and other components.
2. Locate expansion joints where and in pattern indicated.
3. Locate expansion joints at maximum intervals of 20 feet, unless otherwise indicated.
4. Form joints with joint filler extending from bottom of pavement.
5. Extend joint fillers full width and depth of joint.
    a. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
    b. Place top of filler flush with finished concrete surface when no joint sealant is indicated.
6. Furnish joint fillers in one-piece lengths for full width being placed whenever possible.
    a. Where more than one length is required, lace or clip joint-filler sections together.
7. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
8. Secure joint filler to resist movement by wet concrete.

E. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

F. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:

1. Tooled Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with a radiused jointer tool of the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate tool marks on concrete surfaces.
    a. Radius: 1/4 inch.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into hardened concrete when cutting

action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.

a. Cut 1/3 into depth of pavement.

G. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool of the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

1. Radius: 1/4 inch.

3.7 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from substrate surface and reinforcing before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten substrate to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes, grilles or frames, or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery, at Project site, or during placement.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

1. When concrete placement is interrupted for more than ½-hour, place a construction joint.
2. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed paved surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open-textured and uniform, smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations.

I. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85-percent of its 28-day compressive strength.

J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

K. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:

   1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with powerdriven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of ¼-inch in 10-feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

   1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
   2. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
   3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating floatfinished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

C. Final Tooling: Tool edges of paving, curbs, gutters, and joints formed in fresh concrete with a jointing tool of the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

   1. Radius: ¼-inch. D. Finishing Schedule:

   1. Area Paving: Light Broom Finish and tool edges.
   2. Sidewalk Paving: Light Broom Finish, radius exposed raised edges to ½-inch radius, and tool edges.
   3. Curbs and Gutters: Light Broom Finish and tool edges.
   4. Inclined Vehicular Ramps: Course Broomed perpendicular to slope.

5. Inclined Handicapped Ramps: Course Broomed perpendicular to slope or V-Jointed perpendicular to slope.
6. Exterior Steps-on-Grade: Course Broom Finish or Slip-Resistant Aggregate Finish.

E. Place curing compound or sealer on exposed surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Curing: Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7-days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3-hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 REMOVAL OF FORMS AND SUPPORTS

A. Provided that concrete has hardened sufficiently that it will not be damaged, forms may be removed after concrete has cured at not less than 50 deg F for 8-hours. Maintain curing and protection operations after form removal.

B. Perform structural repairs with prior approval of the Architect/Engineer for method and procedure, using epoxy-bonding systems. The Architect/Engineer's approval is required for repair methods using materials other than those specified.

3.11 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.12 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect/Engineer.

B. Allow concrete pavement to cure for 28-days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Broadcast glass spheres uniformly into wet pavement markings at a rate of 6 lb/gal..

3.13 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests as specified in Division 1 Specification Sections and this Section. The Contractor shall coordinate with testing agency and perform the following:

1. Provide free access to concrete operations at project site and cooperate with appointed firm.
2. Submit proposed mix design of each class of concrete to testing firm for review prior to commencement of concrete operations.
3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

B. Testing Agency: The Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

C. Testing Services: Testing shall be performed according to the following requirements:

1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump: ASTM C 143; one (1) test at point of placement for each compressive-strength test, but not less than one (1) test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
3. Air Content: ASTM C231, pressure method; one (1) test for each compressive-strength test, but not less than one (1) test for each day's pour of each type of air-entrained concrete.
4. Concrete Temperature: ASTM C1064; one (1) test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one (1) test for each set of compressivestrength specimens.

5. Compression Test Specimens: ASTM C31; one (1) set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
6. Compressive-Strength Tests: ASTM C39; one (1) set for each day's pour of each concrete class exceeding 5-cu. yd., but less than 25-cu. yd., plus one (1) set for each additional 50cu. yd.. One (1) specimen shall be tested at 7-days and two (2) specimens at 28-days; one (1) specimen shall be retained in reserve for later testing if required.
7. When frequency of testing will provide fewer than five (5) compressive-strength tests for a given class of concrete, testing shall be conducted from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used.
8. When total quantity of a given class of concrete is less than 50-cu. yd., Architect/Engineer may waive compressive-strength testing if adequate evidence of satisfactory strength is provided.
9. When strength of field-cured cylinders is less than 85-percent of companion laboratorycured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
10. Strength level of concrete will be considered satisfactory if averages of sets of three (3) consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to the Architect/Engineer, concrete manufacturer, and Contractor within 24-hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28-days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Architect/Engineer but will not be used as the sole basis for approval or rejection.

F. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by the Architect/Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

3.14 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Drill test cores where directed by the Architect/Engineer when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14-days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 1300

SECTION 32 1313 - CONCRETE PAVING

PART 1 GENERAL 1.01 RELATED SECTIONS

A. Subbase Course and Other Earthwork: Section 31 2000

1.02 REFERENCES

A. Comply with American Concrete Institute, ACI 301-05, for the Work of this Section unless otherwise indicated on the drawings or specified.

1.03 SUBMITTALS

A. Product Data:
1. Concrete Design Mix: Submit proposed concrete design mix together with name and location of batching plant at least 28 days prior to the start of concrete work.
2. Portland Cement: Brand and Manufacturer's name.
3. Air-entraining Admixture: Brand and manufacturer's name.
4. Water-reducing or High Range Water-reducing Admixture: Brand and manufacturer's name.
5. Curing and Anti-Spalling Compound: Manufacturer's specifications and application instructions.
6. Fibrous Concrete Reinforcement: Manufacturer's specifications, and batching and mixing instructions for fibrous concrete reinforcement.
7. ADA Detectable Warning Surface: Manufacturer's specifications, product data, test reports, method of installation, and maintenance instructions.

B. Samples:
1. Fabric Reinforcement: Two Feet Square.
2. Fibrous Concrete Reinforcement: One pound.
3. ADA Detectable Warning Surface: Two samples, the same color as the material to be installed, 6 inches x 8 inches minimum.

C. Performance Criteria Submittals:
1. Certifications:
   a. Submit written certification from the product manufacturers to verify the product information supplied.
   b. Submit written certification to verify the amount of recycled material, by weight included in the concrete design mix.
2. Product Data Sheets: Submit written certification that the materials meet the Performance criteria, as stated in the QUALITY ASSURANCE Article below. Stamp each Product Data Sheet and initial or sign the stamp to that the submitted products are the products installed in the project.
3. Material Safety Data Sheets, for all applicable products. If the material data sheets do not contain the VOC content in grams per liter, then other manufacturer certification of VOC levels must be provided.

1.04 QUALITY ASSURANCE

A. Concrete batching plants shall be currently approved as concrete suppliers by the South Carolina Department of Transportation.

B. Fibrous Concrete Reinforcement:
1. Certificates: Affidavit by the concrete supplier certifying that approved fibrous concrete reinforcement in the required amount per cubic yard was added to and properly mixed into each batch of concrete discharged at the site.

C. Performance Criteria: The following criteria are required for the products included in this section:
1. Cast-in-place Concrete shall contain post-industrial and/or post-consumer recycled content as follows:

a. Fly Ash: Concrete shall incorporate fly ash as a replacement for 15 percent (by weight) of the Portland cement. All design mixes are subject to review and approval by the Owner's Soils Engineer or Owner's Representative.
b. GGBF (Ground Granulated Blast Furnace) Slag: Concrete shall incorporate GGBF slag as a replacement for at least 20 percent (by weight) of the Portland cement. All design mixes are subject to review and approval by the Owner's Soils Engineer or Owner's Representative.
c. Certification of recycled content shall be in accordance with the SUBMITTALS Article above.
d. Recycled Steel: Reinforcing bar, steel wire, welded wire fabric, and miscellaneous steel accessories shall contain a minimum of 35 percent (combined) postindustrial/postconsumer recycled content (the percentage of recycled content is based on the weight of the component materials).

2. Concrete manufactured within 500 miles of the project site shall be documented in accordance with the SUBMITTALS Article above.
3. Steel reinforcement manufactured within 500 miles of the project site shall be documented in accordance with SUBMITTALS Article above.

1.05 DELIVERY

A. Batch Ticket Information: Indicate on the delivery ticket the type, brand, and amount of fibrous concrete reinforcement material added to each batch of concrete.

PART 2 PRODUCTS 2.01 MATERIALS

A. Cast-In-Place Concrete: Normal weight, air entrained concrete with a minimum compressive strength of 4,000 psi at the end of 28 days.
1. Design Air Content: ASTM C 260, 6 percent by volume plus or minus 1.5 percent.
2. Cement: ASTM C 150 Type I or II Portland cement. Minimum 6.5 bags or 611 pounds per cubic yard.
3. Water: Potable.
4. Slump: Between 2 and 4 inches; except when a water-reducing admixture is used maximum slump shall be 6 inches and when a high range water reducing admixture is used maximum slump shall be 8 inches.
5. Water-reducing Admixture: ASTM C 494 Type A.
6. High Range Water-reducing Admixture: ASTM C 494 Type F.

B. Chemical Curing and Anti-Spalling Compound: ASTM C 309, Type 1D or 2, Class B, with minimum 18 percent total solids content. The volatile organic compound (VOC) content of concrete curing compounds shall meet requirements of the EPA national AIM VOC regulations.
1. Lin-Seal White by W.R. Meadows, Inc., PO Box 338, Hampshire, IL 60140.
2. KUREZ W VOX or KUREZ VOX WHITE PIGMENTED by The Euclid Chemical Company, 19218 Redwood Road, Cleveland, OH 44110.
3. Thinfilm 422 by Kaufman Products, Inc. 3811 Curtis Avenue, Baltimore, MD 21226.

C. Fabric Reinforcement: Flat sheets of 6 x 6 - W2.9 x W2.9 ASTM A 185, welded wire fabric.

D. Fibrous Concrete Reinforcement: Collated Fibrillated type; ASTM C 1116 and ASTM C 1018, 100 percent virgin, homopolymer polypropylene fibers specifically manufactured for use as concrete reinforcement. Fiber Length: 3/4 to 1.5 inch. Specific Gravity: 0.9.
1. Grace Fibers by W.R. Grace & Company – Conn., Construction Products, 62 Whittemore Ave., Cambridge, MA 02140.
2. Fibermesh by Propex Concrete Systems Corp., 6025 Lee Highway, Suite 425, PO Box 22788, Chattanooga, TN 37422.
3. FORTA Econo-Mono by Forta Corporation, 100 Forta Dr., Grove City, PA 16127.

4. ProMesh Fibrillated Fibers by Pro Mesh Fiber Systems, Division of Canada Cordage Inc., 50 Ottawa St. S., Kitchener, Ontario, Canada N2G 3S7.

E. ADA Detectable Warning Surface: Precast or prefabricated paving units with a non-slip texture on the travel surface. Color shall be a shade of brick red. There shall be a minimum of 70 percent contrast in light reflectance between the detectable warning surface and the adjoining surfaces. Material used to provide visual warning shall be an integral part of the detectable warning surface. Visual contrast to meet the existing ADAAG A4.2.9.2.

1. ADA Pavers by Whiteacre-Greer, 1400 S. Mahoning Av., Alliance, OH 44601.
2. Detectable Warning System, Detecto-Tile, 10133 Hwy 7, Worcester, NY 12197.
3. Classic Dot Detectable Warning Pavers by Oaks Concrete Products, 1900 Vulcan Blvd., Bartlett, IL 60103.
4. Granite Truncated Dome Pavers by Cold Spring Granite Company, 202 S. Third Avenue, Cold Spring, MN 56320.

PART 3 EXECUTION 3.01 PREPARATION

A. Set forms true to line and grade and anchor rigidly in position.

B. Space expansion joints equally at not more than 40’-0” on center unless otherwise indicated.

C. Place joint filler at expansion joints and where new concrete abuts existing concrete paving and fixed structures or appurtenances. Protect the top edge of the joint filler during concrete placement with a temporary cap and remove after concrete has been placed.

3.02 PLACEMENT OF FABRIC REINFORCEMENT

A. Prior to placement, clean reinforcement thoroughly of mill and rust scale and of coatings that could destroy or reduce bond.

B. Install fabric reinforcement midway between the top and bottom of the concrete slab. Use one of the following methods to ensure the final location of reinforcement at the mid-slab location: Prior to placing concrete, place fabric reinforcement midway between top and bottom of the slab and secure against displacement with the use of chair carriers, or other approved material.

C. Lap edges and ends of adjoining sheets of fabric reinforcement at least half the mesh width. Offset end laps in adjacent sheets to prevent continuous joints at ends. Interrupt reinforcement at expansion joints, stopping 2 inches from edges.

3.03 PLACEMENT OF FIBER REINFORCEMENT

A. Add required amount of fibrous concrete reinforcement to the concrete and mix in accordance with fiber manufacturer’s batching and mixing instructions.

B. Fibers shall be uniformly dispersed in the concrete, and concrete shall be free of fiber balls or lumps when discharged at the Site.

3.04 PLACING CONCRETE

A. Consolidate concrete by spading, rodding, forking, or using an approved vibrator eliminating all air pockets, stone pockets, and honeycombing. Work and float concrete surface so as to produce a uniform texture.

B. Locate construction joints (if any) at expansion joints.

3.05 PLACING DETECTABLE WARNING SURFACE

A. The detectable warning surface shall be installed between 6 inches and 8 inches behind the edge of the curb.

B. Domes shall be aligned on a square grid in the predominant direction of travel to permit wheels to roll between the domes.

C. Install precast units in accordance with the manufacturer’s printed instructions.

D. The curb, detectable warning surface, and sidewalk shall be flush with the elevation of the road surface.

3.06 FINISHING AND CURING

A. Wait until bleeding is stopped before final finishing operations.

B. Keep surface damp but not wet between initial strike off and final finish.
   1. Utilize a fog spray, evaporative inhibitor, or midrange water reducer that is compatible with supplementary cementing materials to help control the amount of surface drying of the fresh concrete.

C. Use minimal working of the surface during finishing.

D. Utilize a magnesium or wood float.

E. Avoid the use of steel finishing trowels and utilize a concrete finishing machine when possible.

F. Finish edges of walk and expansion and control joints with a 1/4 inch radius edging tool.

G. Provide broom finish for walk surfaces.

H. Apply curing and anti-spalling compound in accordance with the manufacturer's printed instructions.

I. Apply curing immediately after final finish.

J. Saw control joints one inch deep after the concrete has set. Space control joints equally between expansion joints at approximately 5'-0" on center, except where a different spacing is shown on the drawings.

END OF SECTION

SECTION 32 9200 - LAWNS AND GRASSING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Preparation of Soil Base.

B. Placing Topsoil.

C. Seeding, mulching, and fertilizing.

D. Hydroseeding, mulching, and fertilizing.

E. Lawn Maintenance.

1.3 RELATED SECTIONS

A. Section 31 2000 – Earth Moving.

B. Section 31 2500 – Sedimentation and Erosion Control.

1.4 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

E. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.5 SUBMITTALS

A. See Division 1 Specification Sections for Submittal Procedures.

B. Product Data: For each type of product indicated.

C. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

D. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.

E. Qualification Data: For landscape Installer.

F. Material Test Reports: For existing surface soil and imported topsoil.

G. Planting Schedule: Indicating anticipated planting dates for each type of grass.

H. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

I. Maintenance Instructions: Recommended procedures to be established by the Owner for maintenance of lawns during a calendar year. Submit before expiration of required maintenance periods.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful seeded lawn establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Specification Sections.

1.7 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

B. Provide certificate of compliance from State Department of Agriculture and local authority having jurisdiction indicating approval of seed mixture.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

1. Seed container shall be labeled to show percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. Deliver fertilizer in waterproof base showing weight, chemical analysis, and name of manufacturer.

1.9 SCHEDULING

A. Planting Restrictions: Plant during one of the periods provided in ‘Seeding Schedule’ at the end of this Section. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.10 MAINTENACE SERVICE

A. Furnish maintenance of seeded areas for three (3) months after Date of Substantial Completion.

B. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

PART 2 - PRODUCTS

2.1 SEED MIXTURE

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: State-certified seed of grass species per ‘Seeding Schedule’, with not less than 95-percent germination, not less than 85-percent pure seed, and not more than 0.5-percent weed seed:

2.2 SOIL MATERIALS

A. Topsoil: As specified in Section 31 2000 – Earth Moving.

B. Topsoil: ASTM D5268, pH range of 5.5 to 7, a minimum of 246-percent organic material content; free of stones 1-inch or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4-inches deep; do not obtain from agricultural land, bogs or marshes.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural limestone containing a minimum 80-percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99-percent passing through No. 8 sieve and a minimum 75-percent passing through No. 60 sieve.
2. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90-percent sulfur, with a minimum 99percent passing through No. 6 sieve and a maximum 10-percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90-percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

H. Diatomaceous Earth: Calcined, diatomaceous earth, 90-percent silica, with approximately 140percent water absorption capacity by weight.

I. Zeolites: Mineral clinoptilolite with at least 60-percent water absorption by weight.

2.4 ORGANIC SOIL AMENDMENTS

A. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.

B. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with at least 0.15-lb of ammonium nitrate or 0.25-lb of ammonium sulfate per cubic foot of loose sawdust or ground bark.

2.5 PLANTING ACCESSORIES

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

B. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

C. Stakes: Softwood lumber, chisel pointed.

D. String: Inorganic fiber.

2.6 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1-percent nitrogen and 10percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20-percent available phosphoric acid.

C. Fertilizer: Commercial 10-10-10; recommended for grass, with 50-percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, to the following proportions:

1. Nitrogen: 10-percent.
2. Phosphoric Acid: 10-percent.
3. Soluble Potash: 10-percent.

D. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50-percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

E. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50-percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20-percent nitrogen, 10-percent phosphorous and 10-percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.7 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15-percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

D. Asphalt Emulsion: ASTM D977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.8 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6inches long.

B. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92lb/sq. yd., with 50 to 65-percent open area. Include manufacturer's recommended steel wire staples, 6-inches long.

2.9 TESTS

A. Provide analysis of topsoil under provision of Division 1 Specification Sections.

B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify that prepared soil base is ready to receive the work of this Section.

C. Seedbed Requirements:

1. Establishment of vegetation should not be attempted on sites that are unsuitable due to inappropriate soil texture, poor drainage, concentrated overland flow, or steepness of slope until measures to correct these problems have occurred.
2. To maintain a good stand of vegetation, the soil must meet certain minimum requirements as a growth medium. The existing soil should meet the following criteria:

    a. Enough fine-grained material (silt and clay) to maintain adequate moisture and nutrient supply (available water capacity of at least 0.05-inches water to 1-inch of soil).
    b. Sufficient pore space to permit root penetration.

    c. Sufficient depth of soil to provide an adequate root zone. The depth to rock or impermeable layers such as hardpans should be 12-inches or more, except on slopes steeper than 2:1 where the additional soil is not feasible.
    d. A favorable pH range for plant growth, usually 6.0 – 6.5.
    e. Freedom from large roots, branches, stones, large clods of earth, or trash of any kind. Clods and stones may be left on slopes steeper than 3:1 if they are to be hydroseeded.

3. If any of the above criteria is not met (if the existing soil is too coarse, dense, shallow or acidic to foster vegetation), special amendments are required. Soil conditioners may be added to the soil to meet the above requirements or, preferably, topsoil may be applied in accordance with the requirements Section 31 20 00– Earth Moving.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

    1. Protect adjacent and adjoining areas from hydroseeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 LAWN PREPARATION

A. Limit lawn subgrade preparation to areas to be planted. Prepare subgrade in accordance with Section 31 20 00 – Earth Moving.

B. Place and prepare topsoil as specified in Section 31 20 00 – Earth Moving.

C. Lime and fertilizer needs should be determined by soil testing.

D. When soil testing is unavailable, follow rates suggested within the individual Seeding Specification later in the section. Application rates usually fall into the following ranges:

    1. Ground Agricultural Limestone:

        a. Light-textured, sandy soils: 1 to 1-1/2 tons/acre.
        b. Heavy-textures, clayey soils: 2 to 3 tons/acre.

    2. Fertilizer:

a. Grasses: 800 to 1,200-lbs/acre of 10-10-10 (or equivalent).
b. Grass-legume mixtures: 800 to 1,200-lbs/acre of 5-10-10 (or equivalent).

E. Apply lime and fertilizer evenly and incorporate into the top 2 to 4-inches of soil by disking or other suitable means. Operate machinery on the contour. When using a hydroseeder, apply lime and fertilizer to a rough, loose surface.

F. Roughen surfaces according to Section 31 2000 – Earth Moving.

G. Complete seedbed preparation by breaking up large clods of earth and raking top of soil into a smooth, uniform surface (on slopes less than 3:1). Fill-in or level depressions that can collect water. Broadcast seed into a freshly loosened seedbed that has not been sealed by rainfall.

H. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2-inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

I. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

J. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.4 SEEDING

A. Seed at a rate specified in the Seeding Schedule. Apply evenly in two (2) intersecting directions. Rake in lightly.

B. Do not seed areas in excess of that which can be mulched on the same day.

C. Planting Season: Per Seeding Schedule.

1. Seeding dates shown in the Seeding Schedule are designated as “best” or “possible”. Seeding, properly performed within the “best” dates have a higher probability of success. It is also possible to have satisfactory establishment when seeding outside of these dates. However, as deviation from these dates occur, the probability of failure increases rapidly. Seeding on the last date shown under “possible” may reduce changes of success by 30 to 50-percent.

D. Use certified seed for permanent seeding whenever possible. Certified seed meets published South Carolina Department of Agriculture standards and should bear an official “Certified Seed” label.

1. Labeling of non-certified seed is also required by Law. Labels contain important information on seed purity, germination, and presence of weed seeds. Seed must meet State standards of content of noxious weeds. Seed containing “prohibited” noxious weed seeds will not be accepted.

E. Inoculate legume seed with the Rhizobium bacteria appropriate to the species of legume.

F. Apply seed uniformly with a cyclone seeder, drop-type spreader, drill, or cultipacker seeder on a firm, friable seedbed.

1.
2.

Do not broadcast or drop seed when wind velocity exceeds 5-mph. Do not use wet seed or seed that is moldy or otherwise damaged.

G. When using a drill or cultipacker seeder, plant small grains no more than 1-inch deep, grasses and legumes no more than 1/2-inch deep. Equipment should be calibrated in the field for the desired seeding rate.

H. When using broadcast-seeding method, subdivide the area into workable sections and determine the amount of seed needed for each section. Apply one-half of the seed while moving back and forth across the area, making a uniform pattern; then apply the second half in the same manner, but in directions perpendicular to the previous pattern.

I. Do not sow immediately following rain, when ground is too dry, or during windy conditions.

J. Cover broadcast seed by raking or chain dragging; then firm the surface with a roller or cultipacker to provide good seed contact.

1. Lightly rake seed into top 1/8-inch of soil.
2. Roll seeded area with roller not to exceed 112-lbs.

K. Immediately following seeding, apply mulch to a thickness of 1/8-inch. Maintain clear of shrubs and trees.

L. Apply water with a fine spray immediately after each area has been mulched. Saturate the top 4-inches of soil.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

B. Hydroseeding should be limited to steeply sloped areas, with a minimum slope of 4:1.

C. Surface Roughening is particularly important when hydroseeding, as a roughened slope will provide some natural coverage for lime, fertilizer, and seed. The surface should not be compacted or smooth. Fine seedbed preparation is not necessary for hydroseeding operations; large clods, stones, and irregularities provide cavities in which seeds can lodge.

D. Apply legume inoculants at four (4) times the recommended rate when adding inoculant to a hydroseeder slurry.

E. If hydroseeding machinery breaks down for a duration of 1/2 to 2-hours, add 50-percent more seed to the tank, based on the proportion of the slurry remaining. This should compensate for any damage to seed. Beyond 2-hours, a full rate of new seed may be necessary.

F. Lime is not normally applied with a hydraulic seeder because of its abrasiveness. It can be blown onto steep slopes in dry form.

1.
2.

G. Apply hydroseed slurry evenly and of sufficient coverage with a hydraulic seeder at a rate shown in the Seeding Schedule. H. Typical Application Rates:

Mix slurry with nonasphaltic or asphalt-emulsion tackifier.
Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 1500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate.

3. Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at a minimum rate of 500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb/acre.
4. Rate of wood fiber (cellulose) application should be at least 2,000 lbs/acre.

I. Use caution near trees, shrubs, and landscaping. Do not allow hydroseed slurry to cover landscaping plants.

J. Immediately following seeding, apply mulch to a thickness of 1/8-inch. Maintain clear of shrubs and trees.

K. Apply additional water, as necessary, with a fine spray after hydroseeding application. Saturate the top 4-inches of soil.

3.6 IRRIGATION

A. Moisture is essential for seed germination and seedling establishment. Supplementary irrigation can be very helpful in assuring adequate stands in dry seasons or to speed development of full cover. It is a requirement for fine turf establishment and should be used elsewhere when feasible. However, irrigation is rarely critical for low maintenance vegetative cover at the appropriate time of the year.

B. Water application rates must be carefully controlled to prevent runoff. Inadequate or excessive amounts of water can be more harmful than no supplementary water.

3.7 SEED PROTECTION

A. Identify seeded area with stakes and string around area periphery. Set string height to 12inches. Space stakes at 8-feet o.c.

B. Protect seeded areas with slopes exceeding 6:1 with erosion-control fiber mesh and 4:1 with erosion-control blankets installed and stapled according to manufacturer's written instructions. Roll fabric onto slopes without stretching or pulling.

1. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated trench. Provide 12-inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
2. Secure outside edges and overlaps with stakes or staples at 36-inch o.c.
3. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
4. At sides of ditches, lay fabric in direction of water flow. Lap ends and edges a minimum of 6-inches.

1.
2.

C. Protect seeded areas with slopes not exceeding 4:1 by spreading straw mulch. Spread uniformly at a minimum rate of 2-tons/acre to form a continuous blanket 1/2-inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

Anchor straw mulch by crimping into topsoil with suitable mechanical equipment. Bond straw mulch by spraying with asphalt emulsion at the rate of 10 to 13-gal./1000 sq. ft.. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

D. Protect seeded areas from hot, dry weather or drying winds by applying topsoil within 24 hours after completing seeding operations. Soak and scatter uniformly to a depth of 3/16 inch and roll to a smooth surface.

3.8 SATISFACTORY LAWNS

A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90percent over any 10-sqft and bare spots not exceeding 5 by 5-inches.

B. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.9 LAWN MAINTENANCE

A. Generally, a stand of vegetation can not be determined to be fully established until soil cover has been maintained for one (1) full year from planting. Inspect seeded areas for failure and make necessary repairs and reseedings with the same season, if possible.

B. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established.

C. Reseeding: If a stand of grass has inadequate cover, re-evaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand of grass after seedbed preparations or over-seed the area. Consider performing temporary seeding, annual species, if the time of year in not appropriate for permanent seeding.

D. If vegetation fails to grow, soil must be tested to determine if acidity or nutrient imbalance is responsible.

E. Re-Fertilization: On the typical disturbed site, full establishment of vegetation requires refertilization in the second growing season. Fine turf grasses require maintenance fertilization. Use soil tests, if possible, or follow the guidelines given in the Seeding Schedule.

F. Mow grass at regular intervals to maintain at a maximum height of 2-1/2-inches. Do not cut more than 1/3 of grass blade height at any one mowing. G. Neatly trim edges and hand clip where necessary.

H. Immediately remove clippings after mowing and trimming.

I. Water to prevent grasses and soil from drying out.

1.
2.

J. Roll surface to remove minor depressions or irregularities.

K. Control growth of weeds. Apply species specific herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides. L. Immediately reseed areas which show base spots.

M. Protect seeded areas with warning signs during maintenance period.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic.

Maintain barricades throughout maintenance period and remove after lawn is established. C.

Remove erosion-control measures after grass establishment period.

3.11 SEEDING SCHEDULE

A. Seed: All seed shall conform to all State Laws and to all requirements and regulations of the South Carolina Department of Agriculture. The several varieties of seed shall be individually packaged or bagged and tagged to show name of seed, net weight, origin, and lot number. Mixture of different types of seed shall be weighed and mixed in the proper proportions per the Seed Schedule.

B. Mixture of seed shall be of the following weights per 1,000-square feet of area during planting dates shown:

1. From May 1st to August 31st:

   a. 4 to 6 oz. Centipede Grass.
   b. 1/2-lbs. Brown Top Millet.
   c. 1/2-lbs. Hulled Bermuda Grass.
   d. 25-lbs. 10-10-10 Fertilizer.
   e. 75-lbs. Limestone.
   f. 2-Bales Grain Straw Mulch.

2. From September 1st to April 30th:

   a. 4 to 6 oz. Centipede Grass.
   b. 1/2-lbs. Annual Rye Grass.
   c. 1/2-lbs. Hulled Bermuda Grass.
   d. 1-1/2-lbs. Unhulled Bermuda Grass.
   e. 25-lbs. 10-10-10 Fertilizer.
   f. 75-lbs. Limestone.
   g. 2-Bales Grain Straw Mulch.

3. If hydroseeding, use 13-lbs. per 1,000-s.f. of low salt formular or 19-19-19 fertilizer instead of 10-10-10 fertilizer to give long-term fertilization benefits.

4. Liquid lime in not a substitute for agricultural lime. A few gallons of liquid lime raises soil pH one (1) point, but this effect is very temporary – usually 45 to 50-weeks. Liquid lime may be used with agricultural lime to give quick results together with the long-term benefits of agricultural lime.
5. Grain straw mulch if the most important ingredient in these seeding recommendations and is 90-percent of the reason for success. Paper and other synthetic mulches may be substituted for grain straw mulch when a hydroseeder is used, but not on steep areas, areas with concentrated water runoff, or on deep sandy soils. (All slopes steeper than 2:1 must be hydroseeded and mulched with grain straw using an approved anchoring method such as tackifier or tractor and straight disk harrow).
6. Growth of Rye Grass and Grain Rye must be mowed in early Spring to encourage the growth of permanent grasses – Bermuda Grass and Centipede Grass.

END OF SECTION 32 9200

SECTION 32 9219 – SEEDING

PART 1 GENERAL

1.01 SUBMITTALS

A. Product Data; Hydro Mulch: Manufacturer's specifications and application rate.

B. Product Data; Erosion Control Blanket: Manufacturer's specifications.

C. Sample: One pound of seed in vendor's unopened package with label and seed analysis.

1.02 QUALITY ASSURANCE

A. Field Examples: Seed samples will be taken by the Owner's Soils Engineer 30 days before sowing for testing. Test analysis will indicate species, purity, percent of germination, and weed content. Results will be sent directly to the Owner's Representative for acceptance or rejection based on these tests.

B. Provide prepackaged seed readily available to the public with quality and purity equal to product of O.M. Scotts and Son, Marysville, OH. On-the-job or made-to-order mixes will not be accepted.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in manufacturer's standard size bags or cartons showing weight, analysis, and the name of the manufacturer. Store as recommended by the manufacturer.

B. Store all seed at the site in a cool dry place as approved by the Owner's Soils Engineer. Replace any seed damaged during storage.

C. Deliver seeds, 30 days in advance of anticipated use, in vendor's unopened packages bearing labels showing vendor's name and seed analysis by weight.

D. Deliver erosion control blanket in manufacturer's standard packing material, showing the name of the manufacturer. Store as approved by the Owner's Soils Engineer.

1.04 SCHEDULING

A. Time for Seeding: Sow grass seed between April 1st and May 15th or between August 15th and October 1st, except as otherwise approved in writing by the Owner's Soils Engineer.

PART 2 PRODUCTS

2.01 FERTILIZER

A. Fertilizer: Mixed commercial fertilizers shall contain total nitrogen, available phosphoric acid and soluble potash in the ratio of 10-6-4 (50% N/UF). 50% of total nitrogen shall be derived from ureaform furnishing a minimum of 3.5% water insoluble nitrogen (3.5% WIN). The balance of the nitrogen shall be present as methylene urea, water soluble urea, nitrate and ammoniacal compounds.

B. Other fertilizers meeting South Carolina Department of Transportation's (SC DOT's) standard specification can be used.

2.02 SEED

A. Furnish fresh, clean, new-crop seed mixed in the proportions specified for species and variety, and conforming to Federal and State Standards.

SEEDING
GREENWOOD SCHOOL DISTRICT 50

B. Acceptable material in a seed mixture other than pure live seed consists of nonviable seed, chaff, hulls, live seed of crop plants and inert matter. The percentage of weed seed shall not exceed 0.1 percent by weight.

C. All seed will be rejected if the label or test analysis indicates any of the following contaminates: Timothy, Orchard Grass, Sheep Fescue, Meadow Fescue, Canada Blue Grass, Alta Fescue, Kentucky 31 Fescue, and Bent Grass. D. Provide the following seed mixture:

A = Min. Percentage of Germination
B = Min. Purity Percentage
C = Weight Pure Live Seed in Mixture

SEED MIX "A"

Name	Variety	A	B	C
Chewings Fescue (Festuca rubra commutata)	Banner, Highlight, Jamestown, or an approved equal.	85	97	25
Kentucky Bluegrass * (Poa pratensis)	Barron, Flyking, Glade, or an approved equal.	80	95	55
Perennial Ryegrass ** (Lolium perenne)	Manhatten II, Pennfine, Yorktown II, or an approved equal.	90	98	20

SEED MIX "B"

Name	Variety	A	B	C
Tall Fescue (Festuca arundinacea)	Alta, Kentucky 13 or an approved equal.	95	---	15
Creeping Red Fescue (Festuca rubra trichophylla)	Ensylva	95	97	20
Kentucky Bluegrass * (Poa pratensis)	Baron, Flyking, Glade, or an approved equal.	75	95	25
Perennial Ryegrass ** (Lolium perenne)	Manhatten II, Pennfine, Yorktown II, or an approved equal.	90	95	40

*Approximately equal proportions of 2 or more improved Bluegrass varieties as listed in the Cornell Recommendations for Turfgrass.

**One or more of the improved Ryegrass varieties as listed in the Cornell Recommendations for Turfgrass.

2.03 MULCH

A. Dry Application, Straw: Stalks of oats, wheat, rye or other approved crops which are free of noxious weeds. Weight shall be based on 15 percent moisture content.

B. Hydro Application: Colored wood cellulose fiber product specifically designed for use as a hydro-mechanical applied mulch. Acceptable Product: Conwed Hydro Mulch, Conwed Fibers, 231 4th Street SW, Hickory, NC.

2.04 EROSION CONTROL BLANKET

A. Erosion Control Blanket: Product - SC150 by North American Green, 14649 Highway 41 North, Evansville, IN 47725.
   1. Stakes: North American Green (6" wire staples).
   2. Stakes: North American Green (6" Bio-Stake).

PART 3 EXECUTION

3.01 PREPARATION

A. Seed Bed: Scarify soil to a depth of 3 inches in compacted areas. Smooth out unsightly variations, bumps, ridges, and depressions which will hold water. Remove stones, litter, or other objectionable material.
   1. Obtain written approval of seed bed from the Owner's Soils Engineer before commencing seeding operations.

3.02 FERTILIZING

A. Apply 10-6-4 fertilizer evenly at the rate of 40 pounds per 1000 sq ft or 2 pounds of nitrogen per 1000 sq ft.

3.03 SEEDING

A. Assume all risks when seed is sowed before approval of seed analysis.

B. Do not seed when the wind velocity exceeds 5 miles per hour.

C. Application Rate:
   1. Seed Mix "A": 5 pounds per 1,000 sq. ft.
   2. Seed Mix "B": 5 pounds per 1,000 sq. ft.
   3. Seed Mix "C": 15 pounds per acre.
   4. Seed Mix "D": 15 pounds per acre.
   5. Seed Mix "E": 3.25 pounds per acre.
   6. Seed Mix "F": 47 pounds per acre @ ration of 42 pounds grass seed mix; * 4 pounds legume; ** 1 pound perennial wildflowers.

D. Dry Application: Sow seed evenly by hand or seed spreader on dry or moderately dry soil.

E. Hydroseeding:
   1. Apply seeding materials with an approved hydroseeder.
   2. Fill tank with water and agitate while adding seeding materials. Use sufficient fertilizer, mulch, and seed to obtain the specified application rate. Add seed to the tank after the fertilizer and mulch have been added. Maintain constant agitation to keep contents in homogeneous suspension. Prolonged delays in application or agitation that may be injurious to the seed will be the basis of rejection of material remaining in tank.
   3. Distribute uniformly a slurry mixture of water, seed, fertilizer, and mulch at a minimum rate of 57 gallons per 1000 sq ft (2500 gallons per acre). The Owner's Soils Engineer may order the amount of water increased if distribution of seeding materials is not uniform.

3.04 MULCHING

A. Dry Application: Within one day after seeding, cover the seeded areas with a uniform blanket of straw mulch at the rate of 100 pounds per 1000 sq ft of seeded area.

B. Hydro Application: Apply approved mulch in accordance with the manufacturer's written instructions and recommended rates of application.

SEEDING
GREENWOOD SCHOOL DISTRICT 50

3.05 EROSION CONTROL BLANKET

A. Erosion Control Blanket: Within one day after seeding, cover sloped areas with a uniform blanket of erosion control blanket. Apply approved blanket in accordance with the manufacturer's written instructions. Do not apply straw mulch in area that erosion control blanket will be covering.

B. Stakes: Install approved stakes in accordance with the manufacturer's written instructions.

3.06 LAWN ESTABLISHMENT

A. Maintain the grass at heights between 2-1/2 inches and 3-1/2 inches on a weekly basis until the physical completion of the Work.

B. Water and protect all seeded areas until final acceptance of the lawn.

3.07 PLACING FILL AND BACKFILL

A. Final acceptance of lawn areas will be granted following Substantial Completion and when a uniform stand of acceptable grass is obtained, with a minimum of 95 percent coverage.

B. Unacceptable lawn areas, dry application: Reseed as specified and fertilized at one-half the specified rate.

C. Unacceptable lawn areas, hydro application: Reseed, fertilize, and mulch at one-half the specified rate, use full water rate.

D. At the physical completion of the Work, the State will assume maintenance responsibilities of the lawn areas.

END OF SECTION

SECTION 33 3000 - SANITARY SEWER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Sanitary sewerage system outside the building to include piping, fittings, and accessories.

B. Connection of building sanitary sewer system to Utility Service/Municipality.

C. Monolithic concrete manholes with modular precast concrete or masonry transitions to lid frames, covers, anchorages, and accessories.

D. Modular precast concrete manhole sections, with tongue-and-groove joints, with modular precast concrete or masonry transitions to lid frames, covers, anchorages, and accessories.

E. Masonry manholes with masonry transitions to lid frames, covers, anchorages, and accessories.

F. Cleanout Access and Accessories.

1.3 RELATED SECTIONS

A. Section 31 2000 – Earth Moving.

B. Section 31 2333 – Trenching and Backfilling for Site Utilities.

C. Section 33 3219 – Packaged Pumping Stations.

D. Division 3 Specification Sections for Cast-in-Place Concrete.

1.4 REFERENCES

A. ASTM A48 – Standard Specifications for Gray Iron Castings; 1994a.

B. ASTM A74 – Standard Specifications for Cast-Iron Soil Pipe and Fittings; 1998.

C. ASTM A123 – Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 1997a.

D. ASTM A746 – Standard Specifications for Ductile-Iron Gravity Sewer Pipe; 1999.

E. ASTM C55 – Standard Specification for Concrete Brick; 1999.

F. ASTM C62 – Standard Specification for Building Brick (Solid Masonry Units made from Clay or Shale); 1999.

G. ASTM C478 – Standard Specification for Precast Reinforced Concrete Manhole Sections; 1997.

H. ASTM C564 – Standard Specification for Rubber Gaskets for Cast-Iron Soil Pipe and Fittings; 1997.

I. ASTM C923 – Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes and Laterals; 1998.

J. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 1999.

K. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 1989 (Re-Approved 1995).

L. ASTM D2729 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 1996a.

M. ASTM D2751 – Standard Specification for Acrylonitrile-Butdiene-Styrene (ABS) Sewer Pipe and Fittings; 1996a.

N. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 1998.

O. ASTM D3753 – Standard Specification for Glass-Fiber-Reinforced Polyester Manholes; 1981 (Re-Approved 1991).

P. AWWA C111/A21.11 – American National Standard for Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings; 1995 (Revised) (ANSI/AWWA C111/A21.11).

Q. IMIAWC (CW) – Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.

1.5 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

B. NPS: Nominal Pipe Size (Diameter).

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. EPDM: Ethylene-propylene-diene-monomer rubber.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.6 PERFORMANCE REQUIREMENTS

B.

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

Force-Main Pressure Ratings: At least equal to system operating pressure, but not less than 150 psig.

1.7 SUBMITTALS

A. See Division 1 Specification Sections for additional submittal procedures.

B. Product Data: For the following:

1. Pipe and Accessories: Provide data including all types of piping, pipe accessories, joints, and fittings to be used.
2. Precast Manholes: Provide data for manhole covers (lids and frames), component construction, features, configuration, joints, inserts, and dimensions.
3. Backwater valves and cleanouts.

C. Shop Drawings: Include locations, plans, elevations, details, piping with sizes and elevations of penetrations, and attachments for the following:

1. Precast concrete manholes, including frames and covers.
2. Cast-in-place concrete manholes and other structures, including frames and covers.
3. Masonry manholes and other structures, including frames and covers.

D. Coordination Drawings: Show manholes and other structures, pipe sizes, locations, and elevations. Include details of underground structures and connections. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between piping and proximate structures.

E. Coordination Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1-inch equals 50-feet and vertical scale of not less than 1-inch equals 5feet. Indicate underground structures and pipe. Show types, sizes, materials, and elevations of other utilities crossing system piping.

F. Design Mix Reports and Calculations: For each class of cast-in-place concrete.

G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

H. Manufacturer’s Installation Instructions: Indicate special procedures required to install Products specified.

I. Manufacturer’s Certificate: Certify that products meet or exceed requirements of these specifications and authorities having jurisdiction. J. Project Record Documents:

1. Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.
2. Identify and describe unexpected variations in subsoil conditions or discovery of uncharted utilities.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.9 REGULATORY REQUIREMENTS

A. Conform to all applicable local and State codes for materials and installation of the Work of this Section.

B. Conform to the conditions and requirements of the SCDHEC Construction Permit.

C. Maintain materials and surrounding air temperature to minimum 50-degrees F prior to, during, and 48-hours after completion of masonry work.

D. Cold Weather Requirements: IMIAWC – Cold Weather Masonry Construction Guide – Specifications and Recommended Practices.

E. Comply with the U.S. Department of Health and Human Services/National Institute for Occupational Safety and Health DHHS (NIOSH) Publication No. 87-113, “A Guide to Safety in Confined Spaces” for all work within, or entries into, confined spaces.

1.10 PROTECTION OF EXISTING UTILITIES

A. Site Information: The approximate locations of known utilities are shown on the Drawings.

B. Site Investigation: Perform site survey, research public utility records, and verify existing utility locations. Locate the exact locations of shown utilities, and locations of any unknown utilities, within the work area using electronic pipe finder equipment or other approved methods.

C. Carefully excavate and expose existing underground utilities ahead of trenching operations.

D. Locate existing structures and piping to be closed and abandoned.

E. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify the Architect/Engineer not less than two (2) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without the Architect/Engineer's written permission.
3. Repair or replace any damaged utility lines or structures to original condition at no additional cost to the Owner.

1.11 PROJECT CONDITIONS

A. Verify existing pipe sizes and invert elevations at tie-in points before commencing installation of pipe. Notify the Architect/Engineer immediately upon discovering any discrepancies from inverts shown on the Drawings.

Coordinate the Work with termination of sanitary sewer connections outside building, connections to Utility Service/Municipality, and trenching.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Stainless-Steel Drainage Systems:

a. Josam Co.; Blucher-Josam Div. 2. Gray-Iron

Backwater Valves and Cleanouts:

a. Josam Co.
b. McWane, Inc.; Tyler Pipe; Wade Div.
c. Smith: Jay R. Smith Mfg. Co.
d. Watts Industries, Inc.; Ancon Drain Div.
e. Watts Industries, Inc.; Enpoco, Inc. Div.
f. Zurn Industries, Inc.; Hydromechanics Div.

3. PVC Backwater Valves and Cleanouts:

a. Canplas, Inc.
b. IPS Corp.
c. NDS, Inc.
d. Plastic Oddities, Inc.
e. Sioux Chief Manufacturing Co., Inc.

4. Manhole Cover Inserts:

a. FRW Industries, Inc.
b. Knutson Manufacturing Co.
c. Parson Environmental Products, Inc.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.
B.

2.3 PIPES AND FITTINGS

A. Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings: ASTM A74, Extra Heavy or Service type, gray iron, inside nominal diameter of 4 to 12 inches, bell and spigot ends, for gasketed joints. {For

use only under buildings or future building locations, unless specifically noted otherwise on the Drawings.}

1. Gaskets: ASTM C564, rubber, compression type, thickness to match class of pipe.
2. Cast-Iron pipe and joints shall comply with ANSI A21.1, A21.6, A21.8, A21.10, and/or A21.11.

B. Ductile-Iron Sewer Pipe: ASTM A746, Pressure Class 350, with cement-mortar lining, inside nominal diameter of bell and spigot ends, for push-on joints.

1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
2. Compact-Pattern, Ductile-Iron Fittings: AWWA C153, for push-on joints.
3. Gaskets: AWWA C111, rubber.

C. Stainless-Steel Drainage Pipe and Fittings: ASME A112.3.1; ASTM A666, Type 304, stainless steel; with socket and spigot ends for gasketed joints.

1. Couplings for NPS 6 to NPS 12: Stainless steel, mechanical type, with seal.

a. Seal Material for General Applications: EPDM, unless otherwise indicated.
b. Seal Material for Fluids Containing Gasoline or Oil: Nitrile-rubber compound, unless otherwise indicated.

D. ABS Sewer Pipe and Fittings: ASTM D2751, bell and spigot ends, for solvent-cemented or gasketed joints.

1. Wall Thickness for NPS 6 to NPS 12: SDR 42.
2. Gaskets: ASTM F477, elastomeric seals.

E. PVC Pressure Pipe: AWWA C900, Class 150, for gasketed joints.

1. PVC Pressure Fittings: AWWA C907, for gasketed joints. 2. Gaskets for PVC Piping: ASTM F 477, elastomeric seals.
3. Ductile-Iron, Compact Fittings: AWWA C153, for push-on joints.
4. Gaskets for Ductile-Iron Fittings: AWWA C111, rubber. F. PVC

Sewer Pipe and Fittings: According to the following:

1. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D3034, SDR 35, for solventcemented or gasketed joints.

a. Gaskets: ASTM F477, elastomeric seals.

2.4 SPECIAL PIPE COUPLINGS AND FITTINGS

A. Pressure-Type Pipe Couplings: AWWA C219, iron-body sleeve assembly matching OD of pipes to be joined, with AWWA C111 rubber gaskets, bolts, and nuts. Include PE film, pipe encasement.

B. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed balljoint

sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated. Include PE film, pipe encasement.

C. Ductile-Iron Deflection Fittings: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include rating

for 250-psig minimum working pressure and for up to 15 degrees deflection. Include PE film, pipe encasement.

D. Ductile-Iron Expansion Joints: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Include rating for 250-psig minimum working pressure and for expansion indicated. Include PE film, pipe encasement.

2.5 PE FILM, PIPE ENCASEMENT

A. ASTM A674 or AWWA C105; PE film, tube, or sheet; 8-mil thickness.

2.6 MANHOLES

A. Normal-Traffic Precast Concrete Manholes: ASTM C478, precast, reinforced concrete, of depth indicated, with provisions for rubber gasketed joints.

1. Diameter: 48-inches minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Gaskets: ASTM C443, rubber.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and cover.
8. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.
9. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.
10. Steps: ASTM C478, individual steps or ladder. Omit steps for manholes less than 60inches deep.
11. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

B. Heavy-Traffic Precast Concrete Manholes: ASTM C913; designed according to ASTM C890 for A-16, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for rubber gasketed joints.

1. Ballast: Increase thickness of one or more precast concrete sections or add concrete to structure, as required to prevent flotation.

2. Gaskets: ASTM C443, rubber.
3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and cover.
4. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.
5. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.
6. Steps: ASTM C478, individual steps or ladder. Omit steps for manholes less than 60inches deep.
7. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

C. Cast-in-Place Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C890 for A-16, heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated.

1. Ballast: Increase thickness of concrete, as required to prevent flotation.
2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and cover.
3. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60inches deep.
4. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.

D. Manhole Frames and Covers: ASTM A536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter cover. Include indented top design with lettering "SANITARY SEWER" cast into cover.

E. Manhole Cover Inserts: Manufactured, plastic form, of size to fit between manhole frame and cover and designed to prevent stormwater inflow. Include handle for removal and gasket for gastight sealing.

1. Type: Solid.

2.7 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C150, Type II.
2. Fine Aggregate: ASTM C33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4,000-psi minimum, with 0.45 maximum water-cementitious materials ratio.
   1. Reinforcement Fabric: ASTM A185, steel, welded wire fabric, plain.
   2. Reinforcement Bars: ASTM A615, Grade 60, deformed steel.

C. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4,000-psi minimum, with 0.45 maximum water-cementitious materials ratio. Include channels and benches in manholes.

   1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

      a. Invert Slope: 1-percent minimum through manhole.

   2. Benches: Concrete, sloped to drain into channel.

      a. Slope: 4-percent minimum.

D. Ballast and Pipe Supports: Portland cement design mix, 3,000-psi minimum, with 0.58 maximum water-cementitious materials ratio.

   1. Reinforcement Fabric: ASTM A185, steel, welded wire fabric, plain.
   2. Reinforcement Bars: ASTM A615, Grade 60, deformed steel.

2.8 MASONRY FOR MANHOLES

A. Concrete Brick Units: ASTM C55, Grade N, Type I–Moisture Controlled, Type II–Nonmoisture Controlled; normal weight, medium weight; nominal modular size of 2-1/4 x 3-5/8 x 7-5/8 – inches. B. Mortar and Grout: Type S.

C. Reinforcement: Formed steel wire, 10/10 gage thick, galvanized finish.

2.9 PROTECTIVE COATINGS

A. Description: One- or two-coat, coal-tar epoxy; 15-mil minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:

   1. Concrete Manholes: On interior surface.
   2. Manhole Frames and Covers: On entire surfaces.

2.10 BACKWATER VALVES

A. Gray-Iron Backwater Valves: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

   1. Horizontal Type: With swing check valve and hub-and-spigot ends.

2. Combination Horizontal and Manual Gate-Valve Type: With swing check valve, integral gate valve, and hub-and-spigot ends.
3. Terminal Type: With bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves: Similar to ASME A112.14.1, horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.11 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass foot-traffic areas.
2. Medium Duty: In paved foot-traffic areas.
3. Heavy Duty: In vehicle-traffic service areas.
4. Extra-Heavy Duty: In roads.
5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.12 PIPE ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6-inches wide and 4-mils thick, continuously inscribed with a description of the utility; colored as follows:

B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6-inches wide and 4mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30-inches deep; colored as follows:

1. Green: Sanitary Sewer systems.

2.13 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Sections 31 20 00 – Earth Moving and 31 23 33 – Trenching and Backfilling for Site Utilities.

B. Cover: As specified in Sections 31 20 00 – Earth Moving and 31 23 33 – Trenching and Backfilling for Site Utilities.

PART 3 - EXECUTION

3.1 EARTHWORK

A. See Sections 31 2000 – Earth Moving and 31 23 33 – Trenching and Backfilling for Site Utilities for additional requirements.
B. Hand trim excavations for accurate placement of pipe to elevations indicated.

C. All sewer piping shall be installed with a minimum of 3-foot of cover.

D. Backfill around sides and to top of pipe with cover fill, tamp in-place and compact, and then complete backfilling.

3.2 SEWER LINE SEPARATION GUIDELINES

A. The location of Sanitary Sewer Lines in relation to Water Lines and Other Utilities shall comply with the requirements established by SCDHEC and "Ten State Standards".

B. When Sanitary Sewers are proposed adjacent to any existing or proposed Potable Water Supply facilities, the following shall apply:

1. Potable Water Supply Interconnections:

   a. There shall be no physical connections between a public or private potable water supply system and a sewer, or appurtenance thereto which may permit the passage of any sewage or polluted water into the potable water supply.
   b. No potable water pipes shall pass through or come into contact with any part of a sewer manhole.

2. Horizontal and Vertical Separation from Potable Water Mains:

   a. Sanitary Sewers shall be laid at least 10-feet horizontally from any existing or proposed Potable Water Line.
   b. In cases where it is not practical to maintain a 10-feet horizontal separation, complying with one of the following conditions may allow, upon agency approval, installation of the Sanitary Sewer closer to a Potable Water Line:

      1) The Potable Water Line is installed in a separate trench.
      2) The Potable Water Line is installed on an undisturbed earth shelf located on one side of the Sanitary Sewer and at an elevation so that the bottom of the Potable Water Line is at least 18-inches above the top of the Sanitary Sewer Line.

3. Crossing:

   a. Sanitary Sewers crossing Potable Water Lines shall be laid to provide a minimum vertical separation of 18-inches between the outside of the Potable Water Line and the Sanitary Sewer Line.
   b. Whenever possible, the Potable Water Line shall be located above the Sanitary Sewer Line.
   c. Where a new Sanitary Sewer Line crosses a new Potable Water Line, a full length of pipe shall be used for both the Sanitary Sewer Line and the Potable Water Line and the crossing shall be arranged such that the joints of each line shall be as far as possible from the point of crossing and from each other.

d. Where a Potable Water Line crosses under a Sanitary Sewer Line, adequate structural support shall be provided for the Sanitary Sewer Line to prevent damage to the Potable Water Line while maintaining line and grade.

3.3 IDENTIFICATION

A. Install continuous underground warning tape during backfilling of trench for all underground sanitary sewer piping. Locate below finished grade, directly over piping. See Section 31 20 00– Earth Moving for underground warning tapes.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

B. Install warning tape a minimum of 12-inches below finish grade and directly above line of pipe.

3.4 PIPING APPLICATIONS

A. General: Include watertight joints.

B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products listed below. Use pipe, fittings, and joining methods according to applications indicated. C. Gravity-Flow Piping: The following piping can be used for the appropriate sizes:

1. Cast-Iron Soil Pipe and Fittings; Hub-and-spigot; Extra-Heavy class, gaskets, and gasketed joints.

   a. Acceptable for Pipe Sizes NPS 4 to NPS 15.

2. Cast-Iron Soil Pipe and Fittings; Hub-and-spigot; Service class, gaskets, and gasketed joints.

   a. Acceptable for Pipe Sizes NPS 4 to NPS 15.

3. Ductile-Iron Sewer Pipe; standard-pattern, ductile-iron fittings; gaskets, and gasketed joints.

   a. Acceptable for Pipe Sizes NPS 4 to NPS 24.

4. Stainless-Steel Drainage Pipe and Fittings; gaskets, and gasketed joints. Use EPDMcompound gaskets, unless otherwise indicated. Use nitrile-rubber-compound gaskets for wastes containing gasoline or oil.

   a. Acceptable for Pipe Sizes NPS 4 to NPS 12.

5. ABS, SDR 42, Sewer Pipe and Fittings; gaskets, and gasketed joints.

   a. Acceptable for Pipe Sizes NPS 8 to NPS 12.

6. PVC Sewer Pipe and Fittings; gaskets, and gasketed joints.

   a. Acceptable for Pipe Sizes NPS 4 and NPS 15.

7. PVC Sewer Pipe and Fittings; gaskets, and gasketed joints.

a. Acceptable for Pipe Sizes NPS 18 to NPS 24. D.

Force-Main Piping: Use the following:

1. Ductile-Iron Sewer Pipe; standard- or compact-pattern, ductile-iron fittings; gaskets, and gasketed joints.

   a. Acceptable for Pipe Sizes NPS 3 to NPS 12.

2. PVC Pressure Pipe, PVC Pressure Fittings; gaskets, and gasketed joints.

   a. Acceptable for Pipe Sizes NPS 4 to NPS 12.

3.5 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

1. Use pressure-type pipe couplings for force-main joints. Include PE film, pipe encasement.

B. Special Pipe Fittings: Use where indicated. Include PE film, pipe encasement.

3.6 INSTALLATION, GENERAL

A. Verify existing pipe sizes and invert elevations at tie-in points before commencing installation of sanitary sewer piping. Notify Architect/Engineer immediately upon discovering any discrepancies from inverts shown on the Drawings.

B. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

C. Verify that trench cut and excavation base is ready to receive Work and excavations, dimensions, and elevations are as indicated on the Drawings.

D. Protect pipe, fittings, and accessories during handling against impacts and free falls. Remove extraneous materials from interior of pipe.

E. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install piping, gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements. Maintain swab or drag in pipeline, and pull past each joint as it is completed.

F. Lay each pipe to slope gradients shown on the Drawings in a manner to ensure a uniform slope gradient; with a maximum variation from true slope of 1/16-inch in 10-feet.

G. Before joining pipe, make sure all contact surfaces are clean and dry. Use gasket lubricants as recommended by pipe manufacturer.

H. Place, fit, join and adjust joints to obtain watertight seal.

I. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

J. Cut-off pipe at manholes flush with interior face of manhole wall to match the shape of the manhole wall.

K. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

L. Install gravity-flow piping and connect to building's sanitary drains, of sizes and in locations indicated. Terminate piping as indicated.

1. Install piping pitched down in direction of flow, at minimum slope of 2-percent, unless otherwise indicated.
2. Install piping with 36-inch minimum cover.

M. Terminate sanitary sewer piping 5’-0” from building exterior wall in locations(s) indicated. Provide temporary pipe plug for piping extending into building to be completed under Division 15 Work.

N. Install force-main piping between and connect to building's sanitary-drainage force main and termination point indicated.

1. Install piping with restrained joints at horizontal and vertical changes in direction. Use cast-in-place concrete supports and anchors or corrosion-resistant rods and clamps.
2. Install piping with 36-inch minimum cover.

O. Install ductile-iron, force-main piping according to AWWA C600.

P. Install PVC force-main piping according to AWWA M23.

Q. Install force-main piping between and connect to packaged sewage pump station outlet and termination point indicated.

R. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

3.7 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to installations indicated.

B. Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings: With rubber gaskets, according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook." Use gaskets that match class of pipe and fittings.

1. Install PE film, pipe encasement over hub-and-spigot, cast-iron soil pipe and fittings according to ASTM A674 or AWWA C105.

C. Ductile-Iron Sewer Pipe with Ductile-Iron Fittings: According to AWWA C600.

1. Install PE film, pipe encasement over ductile-iron sewer pipe and ductile-iron fittings according to ASTM A674 or AWWA C105.

D. Stainless-Steel Drainage Piping: According to ASME A112.3.1 and manufacturer's written instructions.

E. ABS Pipe and Fittings: As follows:

1. Join pipe and gasketed fittings with gaskets according to ASTM D2321.
2. Install according to ASTM D2321. F. PE Pipe and Fittings: As follows:

1. Join pipe, tubing, and gasketed fittings with gaskets for watertight joints according to ASTM D2321 and manufacturer's written instructions.
2. Install according to ASTM D2321 and manufacturer's written instructions.
3. Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings." G.

PVC Pressure Pipe and Fittings: Join and install according to AWWA M23. H.

PVC Sewer Pipe and Fittings: As follows:

1. Join pipe and gasketed fittings with gaskets according to ASTM D2321.
2. Join profile sewer pipe fittings with gaskets according to ASTM D2321 and manufacturer's written instructions.
3. Install according to ASTM D2321.

I. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.

J. Join piping made of different materials or dimensions with couplings made for this application.

Use couplings that are compatible with and that fit both systems' materials and dimensions. K.

Install with top surfaces of components, except piping, flush with finished surface.

3.8 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Form continuous concrete channels and benches between inlets and outlet.

C. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

D. Place concrete base pad, trowel top surface level and smooth.

E. Place manhole section plumb and level, trim to correct elevations, and anchor to base.

F. Install precast concrete manhole sections with gaskets according to ASTM C891. Provide rubber joint gaskets complying with ASTM C443 at joints and sections. Apply bituminous mastic coating at joints of sections.

G. Construct cast-in-place manholes as indicated.

H. Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, build in fabricated metal items and accessories.

I. Cut and fit for pipe, conduits, sleeves, and other penetrations. Seal interface between manholes and piping (and pipe opening patch material) with epoxy bonding compound.

J. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

K. Set cover frames and covers level with tipping, to correct elevations.

L. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3-inches above finished surface elsewhere, unless otherwise indicated. M. Install fiberglass manholes according to manufacturer's written instructions.

3.9 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.10 BACKWATER VALVE INSTALLATION

A. Install horizontal units in piping where indicated.

B. Install combination units in piping and in structures where indicated.

C. Install terminal units on end of piping and in structures where indicated. Secure units to structure walls.

3.11 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe. B. Form bottom of excavation clean and smooth to correct elevation.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 x 18 x 12-inches deep. Set with tops 1-inch above surrounding grade.

E. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

F. Mount lid and frame level in grout, secured to top cone section.

3.12 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.

B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6-inches of concrete with 28-day compressive strength of 3,000-psi.

C. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6inches of concrete with 28-day compressive strength of 3,000-psi.

D. Make branch connections from side into existing piping, NPS 21 or larger, or to underground structures by cutting opening into existing unit large enough to allow 3-inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6-inches of concrete for minimum length of 12-inches to provide additional support of collar from connection to undisturbed ground.

1. Use concrete that will attain minimum 28-day compressive strength of 3,000-psi, unless otherwise indicated.
2. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.13 FIELD QUALITY CONTROL

A. Perform Field Inspection and Testing in accordance with Division 1 Specification Sections.

B. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. Place plug in end of incomplete piping at end of day and when work stops.
2. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

C. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24-inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

D. If tests indicate Work does not meet specified requirements, remove Work, replace and re-test at no additional cost to the Owner. E. General Testing and Inspection:

1. All sewers will be visually inspected, tested, and gauged for infiltration and/or exfiltration.
2. All visible leaks shall be repaired even if infiltration is within allowable limits.
3. Broken or cracked pipe, mislaid pipe, and other defects shall be corrected.
4. All repairs, re-laying of sewers, etc., required to bring the sewers to specified status shall be made at no additional cost to the Owner.
5. Clean and prepare for inspection each block or section of sewer upon completion, or at such other time as directed by the Architect/Engineer.
6. Each section of pipe between manholes shall show a full circle of light when viewed from either end.

7. All testing is to be performed in the presence of the Architect/Engineer or other Owner Representative. Give at least three (3) day advance notice before performing tests.
8. All expenses for testing shall be borne by the Contractor.
9. In the event that the sewer line does not pass all testing, the Contractor shall make all necessary repairs, by a method approved by the Architect/Engineer, at no additional expense to the Owner.

F. Pressure Test: Test in accordance with SCDHEC and Municipal Authority and the following requirements:

1. When groundwater is less than 4-feet (1.2 m) above the top of the sewer pipe, sewers and appurtenances shall successfully pass an air test prior to acceptance.

   a. Plug all wyes, tees, stubs, and service connections with gasket caps of plugs securely fastened or blocked to withstand the internal pressure test. Such plugs or caps shall be removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.
   b. Furnish all necessary testing equipment and perform the test in a manner satisfactory to the Architect/Engineer. Any arrangement of equipment that will provide observable and accurate measurements of an air leakage under the specified condition with be permitted.
   c. Testing of sections of the constructed sanitary sewer, for acceptance, will not be performed until all service connections, manholes, and backfilling, and associated compaction, are completed between the stations to be tested.
   d. Air Testing Procedure: After the plugs are in place and securely blocked, introduce air slowly into the pipe section to be tested until the internal air pressure reaches 4.0 psi greater than the average backpressure of any groundwater that may submerge the pipe. Allow a minimum of 2-minutes for the air pressure to stabilize. Determine the height of the groundwater table at the time of the test.

      1) The pipe and joints shall be considered satisfactory when the time required, in seconds, for the pressure to decrease from 3.5 psi to 2.5 psi greater than the average backpressure of any groundwater that may submerge the pipe in not less than that computed in accordance with the following formulas:

         a) T = (Pipe Diameter) (0.15)

            T = Time per 100 feet

      2) Conduct Air Tests complying with ASTM C828 or C924.

   e. Subsequent Failure: Infiltration of groundwater in an amount greater than specified under Infiltration Testing, following a successful Air Test as specified, shall be considered as evidence that the original test was in error or that subsequent failure of the pipe has occurred.

G. Infiltration Test: Test in accordance with SCDHEC and Municipal Authority and the following requirements:

1. When groundwater is at least 4-feet above the top of the sewer pipe, an infiltration test will be used to determine the integrity of the sewer line.

a. If no leakage is observed, it can be assumed that the line passes the test.

b. If leakage is observed, conduct test using a V-notch sharp crested weir in a wood frame tightly secured to the manhole at the low end of the gravity sewer, or by direct measure, prior to allowing sewage flows in the line.

1) Close the end of the sewer at upstream structures sufficiently to prevent the entrance of water.
2) Discontinue the use of well points or other groundwater pumping operations at least three (3) days prior to testing.
3) Infiltration into the entire system of new sewers, or any one trunk, interceptor or outfall sewer, including connecting laterals, or any stretch of sewer shall not exceed:

a) 200 gal/day/inch of pipe diameter/mile of pipe.

H. Deflection Test: Test in accordance with SCDHEC and Municipal Authority and the following requirements:

1. Perform deflection test on all PVC sewer pipe.
2. No pipe to exceed a deflection of 5-percent.
3. Conduct deflection testing after the final backfill, and compaction thereof, has been inplace at least thirty (30) days and prior to placing the sewer line into operation.
4. Conduct Go/No Go deflection test using a rigid ball or mandrel have a diameter equal to 95percent of the inside diameter of the pipe.
5. Do not use mechanical pulling devices for the deflection tests.

I. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate reports for each test.
5. If authorities having jurisdiction do not have published procedures, perform tests as follows:

a. Sanitary Sewerage: Perform hydrostatic test.

1) Allowable leakage is a maximum of 50 gal. per inch of nominal pipe size per mile of pipe, during 24-hour period.
2) Close openings in system and fill with water.
3) Purge air and refill with water.
4) Disconnect water supply.

5) Test and inspect joints for leaks.
6) Option: Test ductile-iron piping according to AWWA C600, Section "Hydrostatic Testing." Use test pressure of at least 10 psig.

b. Sanitary Sewerage: Perform air test according to UNI-B-6.

1) Option: Test concrete piping according to ASTM C 924.

c. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than one and one-half times maximum system operating pressure, but not less than 150 psig.

1) Ductile-Iron Piping: Test according to AWWA C600, Section "Hydraulic Testing."
2) PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

6. Manholes: Perform hydraulic test according to ASTM C 969.
7. Leaks and loss in test pressure constitute defects that must be repaired.
8. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.14 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is completed.

END OF SECTION 33 3000

SECTION 33 4000 - STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Storm drainage culvert, collections, and main system piping, fittings, and accessories

B. Connection of Storm Drainage Collector System to building storm drainage systems, building downspout drains, and Storm Drainage Main System.

1.3 RELATED SECTIONS

A. Section 31 2000 – Earth Moving.

B. Section 31 2333 – Trenching and Backfilling for Site Utilities.

C. Section 33 4616 – Subdrainage.

D. Division 3 Specification Sections for Cast-in-Place Concrete.

1.4 REFERENCES

A. AASHTO M 252 (latest edition).

B. AASHTO M 294 (latest edition).

C. ASTM A74 – Standard Specification for Cast-Iron Soil Pipe and Fittings; 1998.

D. ASTM C14 – Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe; 1999.

E. ASTM C76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 1999a.

F. ASTM C443 – Standard Specification for Joints in Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets; 1998.

G. ASTM C564 – Standard Specification for Rubber Gaskets for Cast-Iron Soil Pipe and Fittings; 1997.

H. ASTM C990 – Specification for Joints for Concrete Pipe Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

I. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120; 1999.

J. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 1989 (Re-Approved 1995). K. ASTM D2412 (latest edition).

L. ASTM D2729 – Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 1996a.

M. ASTM D2751 – Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings; 1996a.

N. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 1998.

O. ASTM F447 (latest edition).

1.5 DEFINITIONS

A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

B. ABS: Acrylonitrile-butadiene-styrene plastic.

C. EPDM: Ethylene-propylene-diene-monomer rubber.

D. PE: Polyethylene plastic.

E. PVC: Polyvinyl chloride plastic.

1.6 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.7 SUBMITTALS

A. See Division 1 Specification Sections for submittal procedures.

B. Product Data: For the following:

1. Piping, Pipe Fittings, and Accessories.
2. Stormwater cleanouts.

C. Manufacturer’s Installation Instructions: Indicate special procedures required to install Products specified.

D. Manufacturer’s Certificate: Certify that products meet or exceed specified requirements.

E. Coordination Drawings: Show basins and other structures, pipe sizes, locations, and elevations. Include details of underground structures and connections. Show other piping in same trench and clearances from sanitary sewerage system piping. Indicate interface and spatial relationship between piping and proximate structures.

F. Design Mix Reports and Calculations: For each class of cast-in-place concrete.

G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

H. Project Record Documents: Survey location of pipe runs, catch basins, junction boxes, outlet structures and corresponding invert elevations

1. The Contractor shall submit to the Architect/Engineer, prior to substantial completion, a record survey in digital DWG format.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.9 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify the Architect/Engineer not less than two (2) days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect/Engineer's written permission.

D. Verify existing pipe sizes and invert elevations at tie-in points before commencing installation of pipe. Notify the Architect/Engineer immediately upon discovering any discrepancies from inverts shown on the Drawings.

E. Coordinate the Work with termination of storm sewer connections outside building, trenching, connection to building downspout drains, connection to foundation drainage system and connection to existing site storm drainage system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Gray-Iron Cleanouts:

a. Josam Co.
b. McWane, Inc.; Tyler Pipe; Wade Div.
c. MIFAB.
d. Smith: Jay R. Smith Mfg. Co.
e. Watts Industries, Inc.; Ancon Drain Div.
f. Watts Industries, Inc.; Enpoco, Inc. Div.
g. Zurn Industries, Inc.; Hydromechanics Div.

2. PVC Cleanouts:

a. Canplas, Inc.

b. IPS Corp.
c. NDS, Inc.
d. Plastic Oddities, Inc.
e. Sioux Chief Manufacturing Co., Inc.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 PIPES AND FITTINGS – CULVERTS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C76, Class III, Wall Type B.

1. Joint Devices: ASTM C990, Preformed Flexible Joint Sealant.
2. Acceptable Nominal Pipe Sizes: 12” to 144”.

B. Reinforced-Concrete Elliptical Pipe: ASTM C507, Class IV, for banded joints.

1. Pattern: Type HE, horizontal.
2. Sealing Bands: ASTM C877, Type I.
3. Acceptable Nominal Pipe Sizes: 12” to 144”.

2.4 PIPES AND FITTINGS

A. Cast-Iron Soil Pipe and Fittings: ASTM A74, Standard grade, gray iron, hub and spigot ends, for gasketed joints.

1. Cast Iron Pipe Joint Devices: ASTM C564, rubber gaskets, compression type, thickness to match class of pipe.
2. Acceptable Nominal Pipe Sizes: 4” to 15”.

B. Hubless Cast-Iron Soil Pipe and Fittings: CISPI 301 or ASTM A888, gray iron, hubless ends, for coupling joints.

1. Stainless-Steel Shielded Couplings: ASTM C1277 and CISPI 310, corrugated, stainlesssteel shield and clamp assembly, with ASTM C564 rubber sealing sleeve.
2. Stainless-Steel, Heavy-Duty Couplings: ASTM C1277; clamp assembly with housing fabricated from stainless steel complying with ASTM A666, Type 304; and rubber sealing gasket complying with ASTM C564. Include 4-inch wide housings.
3. Cast-Iron, Heavy-Duty Couplings: ASTM C1277, assembly with housing of gray iron complying with ASTM A48, stainless-steel bolts, and rubber sealing gasket complying with ASTM C564.
4. Acceptable Nominal Pipe Sizes: 4” to 10”.

C. Ductile-Iron Sewer Pipe: ASTM A746, for push-on joints.
1. Standard-Pattern, Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
2. Compact-Pattern, Ductile-Iron Fittings: AWWA C153, for push-on joints.
3. Gaskets: AWWA C111, rubber.
4. Acceptable Nominal Pipe Sizes: 4” to 12”.

D. ABS Sewer Pipe and Fittings: ASTM D2751, SDR 42, for gasketed joints.

1. Gaskets: ASTM F477, elastomeric seals.
2. Acceptable Nominal Pipe Sizes: 4” to 12”.

E. Corrugated HDPE Drainage Tubing and Fittings: AASHTO M252, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings to form silttight joints.
2. Acceptable Nominal Pipe Sizes: 4” to 10”.

F. Corrugated HDPE Pipe and Fittings: AASHTO M294, Type S, with smooth waterway for coupling joints.

1. Silttight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings to form silttight joints.
2. Acceptable Nominal Pipe Sizes: 4” to 10”.

G. HDPE Plastic Pipe and Fittings: Corrugated high density polyethylene pipe; AASHTO M252, AASHTO M294 & ASTM D2412, and ASTM F477, Type S, Dual wall, Smooth core, bell and spigot end joints.

1. HDPE Plastic Pipe Joint Devices: ASTM F477 rubber compression gasket joint devices. Rubber gaskets are to be covered with a protective removable wrap.
2. Acceptable Nominal Pipe Sizes: 6” to 24”.

H. Cellular-Core PVC Pipe: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, for solventcemented joints.

1. Fittings: ASTM D2729 or ASTM D3034, PVC sewer pipe fittings.
2. Acceptable Nominal Pipe Sizes: 4” to 6”.

I. PVC Sewer Pipe and Fittings: ASTM D3034, SDR 35, for solvent-cemented or gasketed joints.

1. Gaskets: ASTM F477, elastomeric seals.
2. Acceptable Nominal Pipe Sizes: 4” to 15”.

2.5 SPECIAL PIPE COUPLINGS AND FITTINGS

A. Sleeve-Type Pipe Couplings: ASTM C1173, rubber or elastomeric sleeve and band assembly fabricated to mate with OD of pipes to be joined, for nonpressure joints.

1. Sleeve Material for Cast-Iron Soil Pipe: ASTM C564, rubber.
2. Sleeve Material for Plastic Pipe: ASTM F477, elastomeric seal.
3. Sleeve Material for Dissimilar Pipe: Compatible with pipe materials being joined.
4. Bands: Stainless steel, at least one at each pipe insert.

B. Bushing-Type Pipe Couplings: ASTM C1173, rubber or elastomeric bushing fabricated to mate with OD of smaller pipe and ID of adjoining larger pipe, for nonpressure joints.

1. Material for Cast-Iron Soil Pipe: ASTM C564, rubber.
2. Material for Plastic Pipe: ASTM F477, elastomeric seal.
3. Material for Dissimilar Pipe: Compatible with pipe materials being joined.

2.6 PE FILM, PIPE ENCASEMENT

A. ASTM A674 or AWWA C105; PE film, tube, or sheet; 8-mil thickness.

2.7 MANHOLES (JUNCTION BOXES)

A. Normal-Traffic Precast Concrete Manholes: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.

1. Diameter: 48-inches minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. Gaskets: ASTM C443, rubber.
7. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and cover.
8. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.
9. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.
10. Steps: ASTM C478, individual steps or ladder. Omit steps for manholes less than 60inches deep.
11. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

B. Heavy-Traffic Precast Concrete Manholes: ASTM C913; designed according to ASTM C890 for A16, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for rubber gasketed joints.

1. Ballast: Increase thickness of one or more precast concrete sections or add concrete to structure, as required to prevent flotation.
2. Gaskets: Rubber.
3. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch- diameter frame and cover.
4. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast or anchor into base, riser, and top section sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.
5. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.
6. Steps: ASTM C478, individual steps or ladder. Omit steps for manholes less than 60inches deep.
7. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

C. Manhole Frames and Covers: ASTM A536, Grade 60-40-18, ductile-iron castings designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange,

and 26-inch-diameter cover. Include indented top design with lettering "STORM SEWER" cast into cover.

D. Manholes are to be sized such that the clearance between the outside wall of pipe and the adjacent interior walls of structure is a minimum of 9-inches.

E. Cut-off pipes at manholes flush with interior face of manhole wall to match the shape of the manhole wall.

2.8 CATCH BASINS

A. Normal-Traffic, Precast Concrete Catch Basins: ASTM C478, precast, reinforced concrete, of depth indicated, with provision for rubber gasketed joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
3. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
4. Gaskets: ASTM C443, rubber.
5. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match frame and grate.
6. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast steps or anchor ladder into base, riser, and top section sidewalls at 12- to 16-inch intervals. Omit steps for catch basins less than 60-inches deep.
7. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.
8. Steps: ASTM C478, individual steps or ladder. Omit steps for catch basins less than 60inches deep.
9. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

B. Heavy-Traffic, Precast Concrete Catch Basins: ASTM C913, precast, reinforced concrete; designed according to ASTM C890 for A-16, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for rubber gasketed joints.

1. Gaskets: Rubber.
2. Grade Rings: Include two or three reinforced-concrete rings, of 6- to 9-inch total thickness, that match frame and grate.
3. Steps: Fiberglass, individual steps or ladder. Include width that allows worker to place both feet on one step and is designed to prevent lateral slippage off step. Cast steps or anchor ladder into base, riser, and top section sidewalls at 12- to 16-inch intervals. Omit steps for catch basins less than 60-inches deep.
4. Steps: Manufactured from deformed, 1/2-inch steel reinforcement rod complying with ASTM A615 and encased in polypropylene complying with ASTM D4101. Include pattern designed to prevent lateral slippage off step. Cast or anchor into sidewalls with steps at 12- to 16-inch intervals. Omit steps for manholes less than 60-inches deep.
5. Steps: ASTM C478, individual steps or ladder. Omit steps for catch basins less than 60inches deep.

6. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

C. Pipe Connectors: ASTM C923, resilient, of size required, for each pipe connecting to base section.

D. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for heavy-duty service. Include flat grate with small square or short-slotted drainage openings.

1. Size: 24 x 24-inches minimum, unless otherwise indicated.
2. Grate Free Area: Approximately 50-percent, unless otherwise indicated.

E. Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for heavy-duty service. Include 24-inch ID by 7- to 9-inch riser with 4-inch minimum width flange, and 26-inch-diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50-percent, unless otherwise indicated.

F. Catch basins are to be sized such that the clearance between the outside wall of pipe and the adjacent interior walls of structure is a minimum of 9-inches.

G. Cut-off pipes at catch basins flush with interior face of manhole wall to match the shape of the manhole wall.

2.9 STORMWATER INLETS

A. Drop Inlets: Horizontal gutter opening, of materials and dimensions indicated. Include heavyduty frames and grates.

B. Combination Curb Inlets: Vertical curb and horizontal gutter openings, of materials and dimensions indicated. Include heavy-duty frames and grates.

C. Frames and Grates: Dimensions, opening pattern, free area, and other attributes indicated.

1. Material: ASTM A536, Grade 60-40-18 minimum, ductile-iron casting.
2. Material: ASTM A48, Class 30 minimum, gray-iron casting.
3. Grate Free Area: Approximately 50-percent, unless otherwise indicated.

2.10 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C150, Type II.
2. Fine Aggregate: ASTM C33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

B. Portland cement Design Mix: 4,000 psi minimum, with 0.45 maximum water-cementitious ratio.

C. Reinforcement Fabric: ASTM A185, steel, welded wire fabric, plain.

D. Reinforcement Bars: ASTM A615, Grade 60, deformed steel.

E. Structure Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4,000 psi minimum, with 0.45 maximum water-cementitious ratio.

F. Ballast and Pipe Supports: Portland cement design mix, 3,000 psi minimum, with 0.58 maximum water-cementitious ratio.

1. Reinforcement Fabric: ASTM A185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A615, Grade 60, deformed steel.

2.11 PROTECTIVE COATINGS

A. Description: One- or two-coat, coal-tar epoxy; 15-mil minimum thickness, unless otherwise indicated; factory or field applied to the following surfaces:

1. Manhole Frames and Covers: On entire surfaces.
2. Catch Basin Frames and Grates: On entire surfaces.
3. Stormwater Inlet Frames and Grates: On entire surfaces.

2.12 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:

1. Light Duty: In earth or grass foot-traffic areas.
2. Medium Duty: In paved foot-traffic areas.
3. Heavy Duty: In vehicle-traffic service areas.
4. Extra-Heavy Duty: In roads.
5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.13 DRAIN BASINS A.

General:

1. PVC surface drainage inlets shall include the drain basin type as indicated on the contract drawing and referenced within the contract specifications. The ductile iron grates (12" and 15" frames are cast iron) for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacturer. The surface drainage inlets shall be as manufactured by Nyloplast, a division of Advanced Drainage Systems, Inc., or prior approved equal.
B. Materials:

1. The drain basins required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The pipe bell spigot shall be joined to the main body of the drain basin or catch basin. The pipe stock used to manufacture the main body and pipe stubs of the surface drainage inlets shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, Standard for Sewer PVC Pipe and Fittings; ASTM F1336, Standard for PVC Gasketed Sewer Fittings.
2. The grates furnished for all surface drainage inlets shall be ductile iron grates for sizes 8", 10", 12", 15", 18", 24", and 30" (12" and 15" frames are cast iron) shall be made specifically for each basin so as to provide a round bottom flange that closely matched the diameter of the surface drainage inlet. Grates for drain basins shall be capable of supporting H-25 wheel loading for heavy-duty traffic or H-10 loading for pedestrian traffic. 12" and 15" grates will be hinged to the frame using pins. Metal used in the manufacture of the castings shall conform to ASTM A536 grade 70-50-05 for ductile iron and ASTM A-48-83 class 30B for 12" and 15" cast iron frames. Grates shall be provided painted black.

2.14 INLINE DRAIN A.

General:

1. PVC surface drainage inlets shall be of the inline drain type as indicated on the contract drawings and referenced within the contract specifications. The ductile iron grates (12" and 15" frames are cast iron) for each of these fittings are to be considered an integral part of the surface drainage inlet and shall be furnished by the same manufacture. The surface drainage inlets shall be as manufactured by Nyloplast, a Division of Advanced Drainage Systems, Inc., or prior approved equal. B. Materials:

1. The inline drain required for this contract shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the furnished configuration. The drainage pipe connection stubs shall be manufactured from PVC pipe stock and formed to provide a watertight connection with the specified pipe system. This joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible elastomeric seals. The pipe bell spigot shall be joined to the inline drain body by use of a swage mechanical joint. The pipe stock used to manufacture the inline drain body and pipe bell spigot of the surface drainage inlets shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, Standard for Sewer PVC Pipe and Fittings; ASTM F1336, Standard for PVC Gasketed Sewer Fittings.
2. The grates furnished for all surface drainage inlets shall be ductile iron grates for sizes 8", 10", 12", 15", 18", 24" and 30" (12" and 15" frames are cast iron) shall be made specifically for each fitting so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet. Grates for inline drains shall be capable of supporting H-25 wheel loading for heavy-duty traffic or H-10 loading for pedestrian traffic. 12" and 15" will be hinged to the frame using pins. Metal used in the manufacture of the castings shall

conform to ASTM A536, Grade 70-50-05 for ductile iron and ASTM A4883, Class 30B for 12" and 15" cast iron frames. Grates shall be provided painted black.

2.15 PIPE OUTLETS

A. Head Walls: Precast or cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregular size and shape, graded stone.

1. Average Size: NSA No. R-5, screen opening 5 inches.

C. Filter Stone: NSA No. FS-2, No. 4 screen opening, average-size, graded stone.

D. Energy Dissipators: NSA No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.1 TRENCHING

A. See Section 31 20 00 – Earth Moving and Section 31 23 33 – Trenching and Backfill for Site Utilities for additional information.

B. Hand trim excavations for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover material, tamp in-pace and compact, and then complete backfilling.

3.2 IDENTIFICATION

A. Install continuous underground warning tape during backfilling of trench for all underground storm drainage piping. Locate below finished grade, directly over piping. See Section 31 20 00 – Earth Moving for underground warning tapes.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

B. Install warning tape a minimum of 12-inches below finish grade and directly above line of pipe.

3.3 PIPING APPLICATIONS

A. General: Include watertight, or silttight joints.

B. Refer to Part 2 of this Section for detailed specifications for pipe and fitting products. Use pipe, fittings, and joining methods according to applications indicated.

3.4 SPECIAL PIPE COUPLING AND FITTING APPLICATIONS

A. Special Pipe Couplings: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.

1. Use the following pipe couplings for nonpressure applications:

a. Sleeve type to join piping, of same size, or with small difference in OD.

b. Increaser/reducer-pattern, sleeve type to join piping of different sizes.
c. Bushing type to join piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

B. Special Pipe Fittings: Use where indicated. Include PE film, pipe encasement.

3.5 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

B. Verify existing pipe sizes and invert elevations at tie-in points before commencing installation of pipe. Notify the Architect/Engineer immediately upon discovering any discrepancies from inverts or sizes shown on the Drawings.

C. Verify that trench is ready to receive Work and excavations, dimensions, and elevations are as indicated on the Drawings.

D. Install pipe, fittings, and accessories in accordance with manufacturer’s instructions. Seal watertight.

E. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

F. Use manholes for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

G. Use proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

H. Install gravity-flow piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

1. Install piping pitched down in direction of flow, at minimum slope of 1/2-percent, unless otherwise indicated.

I. Extend storm drainage piping and connect to building's storm drains, of sizes and in locations indicated. Terminate piping as indicated.

J. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

3.6 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to installations indicated.
B. Hub-and-Spigot, Cast-Iron Soil Pipe and Fittings: With rubber gaskets according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook." Use gaskets that match class of pipe and fittings.

1. Install PE film, pipe encasement over hub-and-spigot, cast-iron soil pipe and fittings according to ASTM A 674 or AWWA C105.

C. Hubless Cast-Iron Soil Pipe and Fittings: With CISPI-type couplings according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."

1. Install PE film, pipe encasement over hubless cast-iron soil pipe and fittings according to ASTM A 674 or AWWA C105.

D. Hubless Cast-Iron Soil Pipe and Fittings: With heavy-duty-type couplings according to CISPI 310, CISPI's "Cast Iron Soil Pipe and Fittings Handbook," and coupling manufacturer's written instructions.

1. Install PE film, pipe encasement over hubless cast-iron soil pipe and fittings according to ASTM A 674 or AWWA C105.

E. Ductile-Iron Sewer Pipe with Ductile-Iron Fittings: According to AWWA C600.

1. Install PE film, pipe encasement over ductile-iron sewer pipe and ductile-iron fittings according to ASTM A 674 or AWWA C105. F. ABS Pipe and Fittings: As follows:

1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
2. Install according to ASTM D 2321. G. HDPE Pipe

and Fittings: As follows:

1. Join pipe, tubing, and fittings with couplings for soiltight joints according to manufacturer's written instructions.
2. Install according to ASTM D 2321 and manufacturer's written instructions.
3. Install corrugated piping according to the Corrugated Polyethylene Pipe Association's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings." H.

PVC Pressure Pipe and Fittings: Join and install according to AWWA M23.

I. PVC Sewer Pipe and Fittings: As follows:

1. Join pipe and gasketed fittings with gaskets according to ASTM D 2321.
2. Install according to ASTM D 2321.

J. Concrete Pipe and Fittings: Install according to ACPA's "Concrete Pipe Installation Manual." Use the following seals:

1. Round Pipe and Fittings: ASTM C 990 Preformed Flexible Joint Sealant.
2. Elliptical Pipe: ASTM C 877, Type I, sealing bands.

K. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.

L. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

3.7 MANHOLE (JUNCTION BOX) INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 1-inch above finished surface elsewhere, unless otherwise indicated.

C. Install precast concrete manhole sections with gaskets according to ASTM C891. Provide rubber joint gaskets complying with ASTM C443 at joints of sections.

1. Form bottom of excavation clean and smooth to correct elevation.
2. Place manhole sections plumb and level, trim to correct elevations.
3. Apply bituminous mastic coating at joints of sections.
4. Set cover frames and covers level without tipping, to correct elevations.

3.8 CATCH-BASIN INSTALLATION

A. General: Install catch basins to sizes and shapes indicated, complete with appurtenances and accessories indicated.

B. Set frames and grates to elevations indicated.

C. Install precast concrete catch basin sections with gaskets according to ASTM C891. Provide rubber joint gaskets complying with ASTM C443 at joints of sections.

1. Form bottom of excavation clean and smooth to correct elevation.
2. Place catch basin sections plumb and level, trim to correct elevations.
3. Apply bituminous mastic coating at joints of sections.

3.9 DRAIN BASIN INSTALLATION

A. The specified PVC surface drainage inlet shall be installed using conventional flexible pipe backfill materials and procedures.

1. The backfill material shall be crushed stone or other granular material meeting the requirements of Class 1 or 2 materials as defined in ASTM D2321.
2. The surface drainage inlets shall be bedded and backfilled uniformly in accordance with ASTM D2321.
3. The drain basin body will be cut at the time of final grade so as to maintain a one-piece, leak-proof structure. No brick, stone, or concrete block will be used to set the grate to the final grade height. For H-25 load rated installations, an 8" to 10" thick concrete ring will be poured under the grate and frame as recommended by details provided from the manufacturer.

3.10 IN-LINE DRAIN INSTALLATION

A. The specified PVC surface drainage inlet shall be installed using convention flexible pipe backfill materials and procedures. The backfill material shall be crushed or other granular material meeting the requirements of Class 1 or 2 materials as defined in ASTM D2321.

B. The surface drainage inlets shall be bedded and backfilled uniformly in accordance with ASTM D2321. For H-25 Load rated installations, an 8" to 10" think concrete ring will be poured under the grate and frame as recommended by details provided to the manufacturer.

3.11 STORM DRAINAGE INLET AND OUTLET INSTALLATION

A. Construct inlet head wall, aprons, and sides of reinforced concrete as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

D. Construct energy dissipators at outlets, as indicated.

3.12 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.13 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1-inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.14 TAP CONNECTIONS

A. Make connections to existing piping and underground structures so finished Work complies as nearly as practical with requirements specified for new Work.

B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

C. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.

D. Make branch connections from side into existing piping, NPS 21 or larger, or to underground structures by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of pipe or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.

1. Use concrete that will attain minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
2. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

E. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.15 FIELD QUALITY CONTROL

A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plug in end of incomplete piping at end of day and when work stops.
3. Flush piping between manholes, catch basins, and other structures to remove collected debris.

B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24-inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 95-percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within specified requirements.
4. Reinspect and repeat procedure until results are satisfactory.

C. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24-hours' advance notice.
4. Submit separate reports for each test.
5. Leaks and loss in test pressure constitute defects that must be repaired.
   Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.16 PROTECTION

A. Protect pipe, structures, and bedding cover from damage or displacement until backfill operations are completed.

END OF SECTION 33 4000

SECTION 33 4616 - SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. Subdrainage systems for the following:

1. Foundations.
2. Retaining walls.

1.3 RELATED SECTIONS

A. Section 31 2000– Earth Moving.

B. Section 31 2333 – Trenching and Backfilling for Site Utilities.

C. Section 33 4000 – Storm Drainage System.

1.4 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene.

B. HDPE: High-density polyethylene.

C. PE: Polyethylene.

D. PP: Polypropylene.

E. PS: Polystyrene.

F. PVC: Polyvinyl chloride.

1.5 SUBMITTALS

A. Product Data: For drainage conduit, drainage panels, and geotextile fabrics.

1. Perforated pipe.
2. Drainage panels.
3. Geotextile fabrics.

1.6 COORDINATION

A. Drainage panel materials and installation shall be compatible with waterproofing of walls below grade.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to various application articles in Part 3 for applications of pipe, tube, fitting, and joining materials.

2.2 DRAINAGE PIPES AND FITTINGS

A. Perforated, PVC Sewer Pipe and Fittings: ASTM D2729, bell-and-spigot ends, for loose joints.

2.3 DRAINAGE CONDUIT

A. Pipe and Fittings: Perforated, smooth PVC complying with ASTM D 4216 and ASTM D 2729.

1. Size: 6-inches high by approximately 2-1/4 inches thick with a minimum flow rate equal to NPS 4 pipe.
2. Fittings: PVC with NPS 4 outlet connection.
3. Couplings: PVC.

2.4 MOLDED-SHEET DRAINAGE PANELS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Wick Drain Corporation.
2. Grace, W. R. & Co.; Construction Products Div.
3. GREENSTREAK/Western Textile Products.
4. JDR Enterprises, Inc.
5. Ling Industrial Fabrics, Inc.
6. TC Mirafi.

B. Description: Prefabricated, composite panels, 36- to 60-inches wide, and manufactured with geotextile facing laminated to molded-plastic drainage core.

C. Drainage Core: Three-dimensional, nonbiodegradable, molded PP or PS.

1. Minimum Compressive Strength: 10,000-lbf/sq. ft. when tested according to ASTM D1621.
2. Minimum Flow Rate: 2.8-gpm per at hydraulic gradient of 1.0 and compressive stress of 25-psig when tested according to ASTM D4716.

D. Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50-percent; complying with the following properties determined according to AASHTO M 288:
1. Survivability: Class 2.
2. Apparent Opening Size: No. 70 sieve, maximum.
3. Permitivity: 0.1 per second, minimum.

E. Film Backing: Polymeric film bonded to drainage core surface.

2.5 FABRIC DRAINAGE PANELS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Akzo Nobel Geosynthetics Co.
2. GSE Lining Technology, Inc.
3. JDR Enterprises, Inc.
4. Strata Systems, Inc.
5. Tensar Earth Technologies, Inc.

B. Description: Prefabricated, composite drainage panels, made with drainage core and filter fabric, for use as part of foundation and retaining-wall drainage system.

C. Drainage Core: Open-construction, resilient, 0.8-inch-thick, nylon-filament mesh.

1. Minimum Flow Rate: 2.4-gpm per foot at hydraulic gradient of 1.0 and normal pressure of 3,600-psig when tested according to ASTM D4716.

D. Drainage Core: 3-dimensional, PE strand, 0.25-inch-thick, nonwoven net.

1. Minimum Flow Rate: 5-gpm per foot at hydraulic gradient of 1.0 and normal pressure of 3,600psig when tested according to ASTM D4716.

E. Filter Fabric: Nonwoven geotextile filter fabric of PP or polyester fibers, or combination of both. Flow rates range from 120- to 200-gpm per sq. ft. when tested according to ASTM D4491.

2.6 INSULATION DRAINAGE PANELS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Diversifoam Products.
2. Dow Chemical Company (The).
3. Owens Corning.
4. Tenneco Building Products.

B. Description: Extruded-polystyrene board insulation complying with ASTM C 578; fabricated with tongue-and-groove edges and with one side having grooved drainage channels, faced with manufacturer's standard, nonwoven geotextile filter fabric.

1. Type IV, 1.6-lb/cu. ft. minimum density and 25-psig minimum compressive strength.

2.7 SOIL MATERIALS

A. See Sections 31 20 00 “Earth Moving” for additional information.

B. Impervious Fill: Clay, gravel, and sand mixture.

C. Drainage Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D448, coarse aggregate, Size No. 57, with 100-percent passing 1-1/2-inch sieve and not more than 5-percent passing No. 8 sieve.

2.8 GEOTEXTILE FILTER FABRICS

A. Woven or nonwoven geotextile filter fabric of PP or polyester fibers, or combination of both. Flow rates range from 110- to 330-gpm per sq. ft. when tested according to ASTM D4491. Available styles are flat and sock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Sections 31 2000 and 31 2333.

3.3 SUBDRAINAGE SYSTEM APPLICATIONS A. NPS

4 Piping:

1. Perforated, PVC sewer pipe and fittings for loose, bell-and-spigot joints.

3.4 FOUNDATION DRAINAGE INSTALLATION

A. Bottom Impervious Fill: Place impervious fill material on subgrade adjacent to bottom of footing after concrete footings have been cured and forms removed. Place and compact impervious fill to dimensions indicated, but not less than 6-inches deep and 12-inches wide.

B. Drainage Fill: Place supporting layer of drainage fill over compacted subgrade to compacted depth of not less than 4-inches. After installing drainage piping, add drainage fill to width of at least 6-inches on side away from wall and to top of pipe to perform tests. After satisfactory testing, cover piping to width of at least 6-inches on side away from footing and above top of pipe to within 12-inches of finish grade. Place drainage fill in layers not exceeding 3-inches in loose depth; compact each layer placed.
   1. Before installing drainage fill, lay flat-style geotextile filter fabric in trench and overlap trench sides. After installing drainage fill, wrap top of drainage fill with flat-style geotextile filter fabric.
   2. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with electrical tape.

C. Install vertical drainage panel as follows:

   1. Coordinate placement with other drainage materials.
   2. Lay perforated, PE or PVC drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
   3. Mark horizontal chalk line on wall at a point that is 6-inches less than panel width above footing bottom. Before marking wall, subtract footing width.

4. Separate 4-inches of fabric at beginning of roll and cut away 4-inches of core. Wrap fabric around end of remaining core.
5. Wrap bottom of panel around drainage pipe.
6. Attach panel to wall at horizontal mark and at beginning of pipe. Place core side of panel against wall. Use concrete nails with washers through product cylinders to attach panel to wall. Place nails from 2- to 6-inches below top of panel, approximately 48-inches apart. Some manufacturers use construction adhesives, metal stick pins, or double-sided tape. Do not penetrate waterproofing. Before using adhesives, discuss with waterproofing manufacturer.
7. If another panel is required on the same row, cut away 4-inches of installed panel core and wrap fabric over new panel.
8. If additional rows of panel are required, overlap lower panel with 4-inches of fabric.
9. Cut panel as necessary to keep top 12-inches below finish grade.
10. For inside corners, bend panel. For outside corners, cut core to provide 3-inches for overlap.
11. Do not use drainage panels as protection over waterproof membrane, unless otherwise approved by waterproofing membrane manufacturer.

D. Fill to Grade: Place native fill material over compacted drainage fill. Place material in loosedepth layers not exceeding 6-inches. Thoroughly compact each layer. Fill to finish elevations and slope away from building.

3.5 RETAINING-WALL DRAINAGE INSTALLATION

A. Drainage Fill: Place supporting layer of drainage fill over compacted subgrade to compacted depth of not less than 4-inches. After installing drainage piping, add drainage fill to width of at least 6inches on side away from wall and to top of pipe to perform tests. After satisfactory testing, cover piping to width of at least 6-inches on side away from footing and above top of

pipe to within 12-inches of finish grade. Place drainage fill in layers not exceeding 3-inches in loose depth; compact each layer placed.

1. Before installing drainage fill, lay flat-style geotextile filter fabric in trench and overlap trench sides. After installing drainage fill, wrap top of drainage fill with flat-style geotextile filter fabric.
2. Encase pipe with sock-style geotextile filter fabric before installing pipe. Connect sock sections with electrical tape.
3. After installing drainage fill, place one layer of flat-style geotextile filter fabric over top of drainage fill, overlapping edges at least 4-inches. B. Install vertical drainage panels as follows:

1. Coordinate placement with other drainage materials.
2. Lay perforated, PE or PVC drainage pipe at base of footing as described elsewhere in this Specification. Do not install aggregate.
3. If weep holes are used in lieu of drainage pipe, cut 1/2-inch-diameter holes on core side at weep-hole locations. Do not cut fabric.
4. Mark horizontal chalk line on wall at a point that is 6-inches less than panel width above footing bottom. Before marking wall, subtract footing width.
5. Separate 4-inches of fabric at beginning of roll and cut away 4-inches of core. Wrap fabric around end of remaining core.
6. Wrap bottom of panel around drainage pipe.

7. Attach panel to wall at horizontal mark and at beginning of wall corner. Place core side of panel against wall. Use concrete nails with washers through product. Use nails from 2- to 6-inches below top of panel, approximately 48-inches apart. Do not penetrate waterproofing.
8. If another panel is required on the same row, cut away 4-inches of installed panel core and wrap fabric over new panel.
9. If additional rows of panel are required, overlap lower panel with 4-inches of fabric.
10. Cut panel as necessary to keep top 12-inches below finish grade.
11. For inside corners, bend panel. For outside corners, cut core to provide 3-inches for overlap.
12. Do not use drainage panels as protection over waterproof membrane, unless otherwise approved by waterproofing membrane manufacturer.

C. Fill to Grade: Place native fill material over compacted drainage fill. Place material in loosedepth layers not exceeding 6inches. Thoroughly compact each layer. Fill to finish grade.

3.6 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Foundation Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5-percent and with a minimum cover of 36-inches, unless otherwise indicated.
2. Retaining-Wall Subdrainage: When water discharges at end of wall into stormwater piping system, install piping pitched down in direction of flow, at a minimum slope of 0.5percent and with a minimum cover of 36-inches, unless otherwise indicated. However, when water discharges through wall weep holes, pipe may be installed with a minimum slope of zero percent.
3. Lay perforated pipe with perforations down.
4. Lay open-joint pipe spaced as indicated on Drawings or, if not indicated, with 1/4-inch space between ends. Cover top two-thirds of joint opening with open-joint screening material and tie with corrosion-resistant wire.
5. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited. C. Install PVC piping according to ASTM D2321.

3.7 PIPE JOINT CONSTRUCTION

A. Join perforated, PVC pipe and fittings according to ASTM D2729, with loose, bell-and-spigot joints.

3.8 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.9 FIELD QUALITY CONTROL

A. Testing: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.10 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 4616